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Federal, State, and local environmental laws and regulations that apply to geothermal energy development are summarized. Most attention is given to those regulations which deal with air pollution, water pollution, solid wastes and impact assessments. Analyses are made of the regulations with respect to resource definition, pollutants currently not controlled, duplicity and overlap in permit and impact assessment requirements, the lack of uniformity of regulations between states, and the probable future approaches to the regulatory problems.

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SURVEY OF ENVIRONMENTAL REGULATIONS APPLYING TO GEOTHERMAL EXPLORATION, DEVELOPMENT, AND USE

by

Mrs. Gene V. Beeland
WAPORA, Inc.
Washington, D.C. 20015

Contract No. 68-01-5913

Project Officer

Robert P. Hartley
Oil Shale and Energy Mining Branch
Industrial Environmental Research Laboratory
Cincinnati, Ohio 45268

INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report examines federal, state, and local environmental laws and regulations that affect the development of geothermal energy. The emphasis is upon those regulations dealing with air and water pollution, solid wastes, and noise. The report should be of interest to those at all government levels who must implement their numerous provisions, and those developers who must abide by them.

Further information on this subject can be obtained from the Oil Shale and Energy Mining Branch of IERL-Ci.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

This report presents the results of a survey of local, state, federal, and federally-approved environmental control ordinances, statutes, regulations, and standards which are applicable or potentially applicable to geothermal development. Requirements relating to air, water, and noise pollution control, solid waste disposal, control of subsidence and radiation, and erosion and sedimentation control are set forth. The effects of federal and state environmental impact review procedures are also evaluated.

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SECTION I

CONCLUSIONS

INTRODUCTION

This report updates an earlier survey of legal requirements with environmental control ramifications which are applicable or potentially applicable to the production and use of geothermal resources (1). Local, state, Federal, and Federally-approved ordinances, statutes, regulations, and standards relating to air and water pollution, noise emissions, land disposal of wastes, and subsidence are reviewed. Some of these documents are specifically directed to geothermal activities while others are more general requirements which, it is assumed, will be applicable to geothermal development. The criteria which mandate the preparation of environmental impact evaluations are detailed along with the information which such assessments must develop. In addition, specific engineering and documentation requirements during drilling and testing of wells are identified.

The term "production and use" is employed throughout the report to mean: the recovery, by any method, of geothermal resources and their subsequent use in electric power generation or in in any other application. The term "geothermal resource" is used in a broad context to include four types of systems -- vapor-dominated, hot-water, hot dry-rock, and geopressured.

These systems may be described as follows:

Vapor-dominated: Vapor-dominated geothermal resources contain saturated or superheated steam. Currently, only six major reservoirs of this type have been identified worldwide. In the United States, The Geysers field in California, the first commercially producing U.S. geothermal field, is of the vapor-dominated type.

Hot-water or Liquid-dominated: This kind of geothermal resource consists of naturally-occuring liquid water or a two-phase mixture of liquid water and steam at an elevated temperature and pressure. This is the most common type of hydrothermal resource. Hot-water fields are located throughout the western United States.

Hot dry rock: Hot dry rock geological formations have an abnormally high heat content, but do not contain sufficient water or sufficient rock permeability to permit withdrawal of hot water as a heat transport medium. They have some potential, however, for use with circulating surface water as a heat exchange medium.

Geopressured: Geopressured geothermal fields are deep zones of pressurized water with widely varying salinity in which the pressure is caused, at least in part, by the weight of the geological formation (overlying the trapped fluid), which is greater than the weight of an equal volume of fluids. Areas for potential development are located in the Gulf Coast states and may contain large amounts of methane which may be exploitable alone or along with the heat and pressure of the geopressured resource.

The survey centered on 15 states where geothermal resources have been identified. These include: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Louisiana, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming.

The report is structured to present an overview of the environmental requirements of geothermal exploitation; an analysis of existing Federal/state/local governmental control mechanisms to which the geothermal industry is currently subject or may become subject in the future; and identification of constituent or categorical limitations in the form of summaries of specific provisions with potential effect on geothermal development. It excludes those which pertain to acreage limitations, fees, rents, royalties, rate structures, mineral vs. geothermal definition, zoning, tax structure, conversion rights, acquisition, and leasing methods.

The selection of the standards and regulations presented was based on existing information on the probable constituents of wastes generated by geothermal activities. This approach is complicated to a degree by the well-known fact that the constituents of geothermal resources will vary widely from area to area and perhaps even from well to well in the same area, and the wastes produced will thus similarly differ in characteristics and quantities.

The report does not present a "laundry list" of requirements of each statute or regulation discussed. Instead, an overview of common provisions is evolved and unique provisions are described in detail. This technique is sound because of the proclivity of jurisdictions to emulate the environmental requirements of others.

The report documents uncertainties which have created what might be termed a "chicken-and-the-egg" situation in terms of environmental control for the emerging geothermal industry. It raises the question of how much development will occur in the face of minimal certainty as to the precise environmental control requirements which will be applied, and, thus, the range of technologies and expenditures involved. On the other hand, it might be asked, will Federal, state, and local government agencies be motivated to use tight budget and manpower resources to develop the detailed information upon which such limitations must be based until the reality of the industry and its wastes are present?

The term "minimal certainty" relates only to the knowledge of specific "numbers" or control technologies to be mandated, because there is plentiful certainty in today's climate that extensive pollution control will ultimately be required. How soon such constraints will be imposed is another question in face of: 1) the national desire to develop new energy sources; and 2) the desire in some localities and states to expand their industrial economy. Even when applicable regulations are adopted, the degree of enforcement may be tailored to prevailing priorities.

It was stated in the initial survey completed in 1976, that added to the uncertainties specific to geothermal development, major changes in basic environmental control legislation and regulation were being considered by the Congress and within EPA, and the report might well be somewhat out-of-date before it was printed. This statement proved to be true, and many changes in statutes and regulations at all levels of government are reflected in this document. However, it must be stated again that other changes in environmental control are on the horizon. This appears to be unavoidable in a field so relatively new in which policies and technologies must continually change to fit developing needs.

OVERVIEW OF ENVIRONMENTAL REQUIREMENTS ATTENDANT TO GEOTHERMAL DEVELOPMENT

The Federal Geothermal Steam Act of 1970 (P.L. 91-581), designed to permit the exploitation of a resource on Federal lands, was the first such legislation to prescribe blanket environmental protection. The Secretary of the Interior, using his unlimited authority to protect water quality and other environmental qualities, has promulgated geothermal leasing regulations which are also unique in the mineral development/environmental protection interface. The regulations (Title 30 CFR, Parts 270 and 271, and Title 43, Parts 3000 and 3200) and related Geothermal Resources Operations Orders (GRO) mandate that Federal geothermal lessees comply with all applicable Federal, state, and local environmental standards and any more stringent standards which a Geological Survey (USGS) Area Geothermal Supervisor (now Minerals Management Service (MMS) Deputy Minerals Manager for Geothermal) may impose. This directive includes control of all forms of air, land, water, and noise pollution, including but not limited to the control of erosion and the disposal of solid, liquid, and gaseous wastes.

This language contrasts sharply with the more permissive language of the regulations under which oil and gas lessees operate under the Mineral Leasing Act of 1920 (Title 43 CFR, Part 3000). This situation results at least partially from the fact that the U.S. Congress adopted the Geothermal Steam Act as single-purpose legislation -- i.e., as opposed to extending the coverage of the Mineral Leasing Act. This offered the opportunity to impose environmental controls on a new, emerging industry. At the time of the initial survey, the Department of the Interior was contemplating extending the environmental features of the geothermal program -- the first major new program in the Department subsequent to passage of the National Environmental Policy Act -- to other mineral leasing and permitting programs. This action has not been taken.

Most of the 14 states with geothermal statutes providing for the leasing and/or conservation of geothermal resources have also chosen the single-purpose approach. Some of these statutes and/or the implementing regulations -- or the regulations alone in the case of Wyoming where a geothermal statute is just now in preparation -- spell out very detailed environmental control requirements, although they generally stop short of numerical standards on pollutant parameters, except in a few cases for noise and odors.

The standards themselves are found in Federal, state, and local regulations, dealing with all sources or potential sources of pollution, and they relate specifically to control of air, water, or noise pollution or other environmental degradation. It is assumed that geothermal operations are subject to these regulations, or will become subject to them when certain activating steps are taken as described below.

Geothermal activities are also subject to other Federal laws such as the Endangered Species Act of 1973; National Historic Preservation Act of 1966; the Archaeological and Historical Preservation Act of 1974; Coastal Zone Management Act of 1972; Wild and Scenic Rivers Act; and others, along with implementing regulations. Their application is either direct or through stipulation in Federal geothermal leases.

ANALYSIS OF FEDERAL/STATE POLLUTION CONTROL REQUIREMENTS

This country's environmental control programs are basically structured on Federal-state interaction. This is true of the programs established by:

- Clean Air Act (P.L. 95-95, as amended by P.L. 95-190)
- Clean Water Act (P.L. 92-500, as amended by P.L. 95-217)
- Safe Drinking Water Act (P.L. 93-523, as amended by P.L. 95-190)
- Resource Conservation and Recovery Act (P.L. 94-580, as amended by P.L. 95-609 and P.L. 96-482)
- Noise Control Act (P.L. 92-574, as amended by P.L. 95-609)
- National Environmental Policy Act (P.L. 91-190)

All of these statutes are administered at the Federal level by the Environmental Protection Agency although they encourage the states to develop their own implementation and enforcement programs. The provisions of these statutes are applicable to all sources of the type of environmental contamination they are designed to control, including geothermal production and use. In addition, compliance with them is a standard requirement of

Federal geothermal lessees. The lease also requires erosion and sedimentation control although there is no direct Federal authority for this type of regulation nor is there a Federal counterpart to the authority in some state regulations to avoid subsidence.

Air Pollution Control

The primary tool in air pollution control is the emission standard, which limits the amount of a pollutant which may legally enter the atmosphere from any source. The Clean Air Act provides several mechanisms for establishing emission standards. EPA promulgates such standards for hazardous pollutants and sets performance standards for new sources (NSPS) in designated industries. It is not anticipated that either of these types of standards will impact geothermal development in the near future.

In two other emission standard procedures established by the Clean Air Act, the states set the numerical standards. This mechanism is triggered either by promulgation of a national ambient air quality standard -- a goal for acceptable air quality based on scientific criteria -- or adoption by EPA of new source performance standards for an industry. The latter procedure requires the states to adopt emission standards for existing sources in the same industry.

Hydrogen sulfide, perhaps the most troublesome pollutant in geothermal resources because of its odor, is not yet the subject of criteria or either type of standard. This situation could change whenever EPA determines there is a need to take such action.

The states may set emission standards on their own on any pollutant from any stationary source, and some have begun to address hydrogen sulfide. On the other hand, if states fail to adopt emission standards in response to national ambient air standards or NSPS, EPA may then promulgate such standards for the state.

Geothermal power plants may be subject to prevention of significant deterioration (PSD) regulations which severely restrict emissions of regulated pollutants in pristine areas where a large bulk of the geothermal resource is located. If emissions of hydrogen sulfide or particulate exceed 250 tons per year after the application of emission control equipment, the plant will be subject to the stringent PSD requirements. However, for purposes of calculating PSD applicability, the plant and the well field are considered two separate sources. As this report is written, Congress is considering a wide range of changes in the PSD program.

Direct heating systems are less likely to be subject to PSD, especially those utilizing closed systems with no avenue for H_2S escape.

For an industrial facility of any type specifically identified in the regulations (e.g., kraft pulp mills, primary metal smelters, and fuel conversion plants), the cut-off point is 100 tons per year. It is assumed that PSD would apply to such facilities whether or not they utilize geothermal energy.

Water Pollution Control

Under the Clean Water Act, effluent limitations are established for the discharge of pollutants into navigable waters. These limitations are either established in effluent limitation guidelines promulgated for specific industrial categories or on a case-by-case basis. These limitations are incorporated into National Pollution Discharge Elimination System (NPDES) permits. The Act provides that the effluent limitations be established on an industry-by-industry basis -- i.e., effluent limitations guidelines for existing sources in an industry or segment of an industry and standards for new sources in the same categories. These limitations are based on the application of various levels of control technology.

To date, no guidelines or standards have been established which reference the use of geothermal energy. Thus, there are clearly none governing the discharges of geothermal power plants, district heating systems, or agricultural/aquacultural uses of the resource. However, the applicability of the effluent limitations guidelines and new source performance standards for industrial facilities covered by these limitations which utilize geothermal fluids as a source of power or process steam is not as clearcut. Apparently, effluent guidelines, etc., for the industrial facility category would still apply unless a "fundamentally different factors" variance were appropriate in a particular case.

Limitations on the discharges of geothermal operations not covered by prescribed effluent limitations and standards will of necessity be established on a case-by-case. The limitations would still be technology-based where possible. More stringent water quality based limitations could be imposed, if necessary. Since water quality standards may vary from one reach of a stream to another, potential exists for wide variations in applicable limitations. The emphasis today is on the control of 65 toxic pollutants which includes heavy metals such as mercury, lead, and zinc which may be found in geothermal steam and fluids. Federal water quality criteria have been established for these substances. It is not mandatory that the States adopt these criteria.

The Clean Water Act applies the provisions of the National Environmental Policy Act (NEPA) to the issuance by EPA of an NPDES permit for a new source of pollution. It does not apply to State-issued NPDES permits. Where applicable, NEPA requires a very complex and sometimes lengthy assessment of the potential impact that the pollutions source will have on the environment. However, until EPA proposes new source performance standards applicable to geothermal effluents, these operations are not defined as "new sources" and are not subject to this provision of the Clean Water Act. However, it is unlikely that much, if any, geothermal development will take place without being subjected to prior environmental scrutiny because the Federal geothermal regulations cited above require it, and some states have their own NEPA-type statutes as discussed below.

Ocean disposal could be an attractive means of disposing of geothermal brines for facilities located in coastal areas. An NPDES permit is needed for a continuous discharge. Ocean dumping from vessels, if it were to be encountered in geothermal operations, would be regulated under provisions of the Marine Protection Research and Sanctuaries Act.

Control of Underground Injection

EPA has promulgated regulations pursuant to the Safe Drinking Water Act which set minimum requirements that states must meet to obtain primary enforcement authority over underground injection, and provide for flexibility in their programs according to need. EPA may promulgate and administer an injection control program, consistent with these regulations where a state does not submit a program or where a submitted program is not approvable. These programs are designed to prevent the contamination of underground sources of drinking water, which are defined as aquifers supplying drinking water for human consumption or which contain fewer than 10,000 mg/l of total dissolved solids. Aquifers may be exempt from this classification if they are more valuable for geothermal energy production, are severely contaminated, impractical for water supplies because of their location, or are located over a geothermal well area subject to subsidence.

The Safe Drinking Water Act's Underground Injection Control Program regulations defined five classes of injection wells:

Class I - industrial and municipal waste disposal wells;

Class II - injection wells related to oil and gas production;

Class III - mining, geothermal, and other special process wells;

Class IV - hazardous waste injection wells;

Class V - all other injection wells (subsidence control, irrigation return, non-electric geothermal)

Permits are required for (Class III) injection wells associated with geothermal power plants, but the permit requirements will be less restrictive if the well is injecting into an exempt aquifer. Injection wells (Class V) associated with "heat and aquaculture" do not require a permit unless it is shown that they adversely affect primary drinking water standards or human health. (Since the writing of this document, wells associated with geothermal power plants have been changed from Class III to Class V and, thus, they also may not require a permit (47 FR 4999, February 3, 1982).

Solid Waste Disposal

Authority to regulate the management of hazardous wastes and land disposal of non-hazardous municipal wastes was granted to EPA by the Resource Conservation and Recovery Act. Since geothermal drilling muds and brines are exempt from classification as hazardous for two years pending an EPA study of these substances, production and use in power plants and heating systems will be little affected for the present. However, the wastes of industrial facilities utilizing geothermal energy which generate any of the wastes specifically listed in the regulations, or wastes which are toxic, ignitable, corrosive, or reactive, are considered hazardous.

Generators of such wastes are regulated along with those who transport, treat, store, or dispose of them, although generators do not require a permit. However, if wastes are to be stored on the generator's premises for more than 90 days or treated or disposed of on-site, a permit is required, and generators may not allow anyone to handle their hazardous wastes off-site unless they are permitted to do so. The construction and operating standards for treatment, storage, and disposal sites are quite comprehensive.

Generators must prepare a manifest describing the type and quantity of the waste, and a copy must be returned to the generator when the waste is delivered to its destination point. If he fails to receive the copy within specified periods, he must undertake to locate the waste and notify EPA or the cognizant state agency.

Control of Noise

The Noise Control Act of 1972 vested the primary control of noise with state and local governments, but retained Federal regulatory authority over the production of four categories of low-noise level products -- construction and transportation equipment, motors or engines, and electrical or electronic equipment. Until EPA promulgates noise regulations on a product, the states are free to set their own time-of-sale and in-use regulations. When EPA does issue regulations, the state regulations must be consistent.

Federal geothermal lessees are limited by USGS GRO Order No. 4 to noise levels not exceeding 65 dB(A) at a distance of 201 m (660 ft). Nearly all noise measurements of individual operations taken at The Geysers, which is not located on Federal land, probably exceed this standard based on noise levels taken at 2,000 feet. At 50 feet, the dB(A) of individual operations is much greater than the Federal limitation.

Control of Subsidence

The few state attempts to regulate subsidence are divided between surveillance measures, such as survey, benchmark, and monitoring requirements, and "after-the-fact" requirements. The last involves total or partial termination of operations if subsidence is found. The State of California is exemplary in its regulations to control subsidence. Imperial County, in California, requires injection of 80% of the withdrawn geothermal fluid, for example.

Control of Radiation

Radon, a naturally-occurring radioactive gas which has been linked with increased cases of lung cancer, is found in detectable quantities in the geothermal resource in some areas. While ground levels of radon at The Geysers have not been found to exceed California standards, it is not known whether it will be a troublesome contaminant elsewhere.

While EPA is developing programs for disposing of specific low-level radioactive wastes, radon in geothermal fluids is not yet being considered. It appears that states will address this problem through their air and water pollution control and land disposal programs.

ENVIRONMENTAL ASPECTS OF THE FEDERAL GEOTHERMAL LEASING AND DEVELOPMENT PROGRAM

The Bureau of Land Management (BLM) in cooperation with the USGS (now Minerals Management Service) formulates the general requirements of geothermal leases and the special stipulations attached to them. BLM also monitors for compliance with environmental requirements outside the operating area and MMS determines compliance within the operations.

The geothermal leasing regulations, 43 CFR Part 3200, mandate a number of environmentally-related actions by the lessee in addition to the land disposal practices and noise control described previously. In general, lessees must comply with all applicable Federal, state, and local water and air pollution control standards; comply with all Department of the Interior and EPA rules pertaining to the use of pesticides and herbicides; employ such soil and resource conservation measures as the Deputy Minerals Manager deems necessary; take precautions to minimize land subsidence or seismic activity; take esthetics into account in designing facilities; employ measures to protect fish and wildlife and their habitat; conduct activities on known or suspected archaeological, paleontological, or historical sites in accordance with lease terms or special instructions; and restore all disturbed lands in an approved manner. The lessee's plan of operation must disclose the means by which he will implement this list. Monitoring may be required for one year prior to production to develop baseline data on existing air and water quality, noise, seismic and land subsidence activities, and the ecological system of the leased land.

The MMS Deputy Minerals Manager for Geothermal is authorized to shut down operations he determines are causing or can cause pollution. Except in extreme cases, the operator is given a chance to remedy the problems.

GRO Order No. 4, which mandates environmental protection for all stages of geothermal exploration and development on Federal lands in the USGS central and western regions, spells out the above measures in greater detail. And, it is to be remembered that the Deputy Minerals Manager is empowered to set more stringent restrictions in specific field orders.

STATE STATUTES/REGULATIONS APPLICABLE TO GEOTHERMAL DEVELOPMENT

The study of the state air and water pollution control regulations pointed up the fact that very few of the potential pollution parameters of geothermal wastes are covered by existing numerical standards. The ambient air quality and emission standards which are in force today are geared mostly to the products of combustion and processing of materials, and only a handful attempt to limit the levels of the noncondensable gases which may commonly result from geothermal development.

Most states have promulgated emission standards for only the six air contaminants for which EPA originally set ambient air standards: sulfur dioxide, particulates, hydrocarbons (excluding methane), carbon monoxide, ozone, and oxides of nitrogen. None of the gases in this list are found in the various published lists of gases typically associated with geothermal resources. There is evidence in the literature, however, that sulfur dioxide is a natural product of some deposits, and it occurs as a reaction product of hydrogen sulfide at The Geysers power plant. Sulfur dioxide from geothermal sources is considered insignificant, however, as an environmental pollutant. It is doubtful that the hydrocarbon standards which exclude methane and those for carbon monoxide, oxides of nitrogen, and ozone will have any significant effect on geothermal development. The national ambient air quality standard for particulates appears to be the only current ambient standard that might be violated by geothermal operations.

An ambient air standard for lead was promulgated more recently by EPA. This contaminant is found in geothermal hot water resources in some areas; it has not been measured in steam.

Water quality standards more frequently embrace a larger number of the expected geothermal waste constituents, but comparable industrywide, numerical effluent limitations are generally lacking. This circumstance may engender potential disparity in case-by-case treatment in specific requirements as noted above, and uncertainty as to what the limitations may be in any given case.

The general uncertainty is further complexed by the question of whether the nature of some existing standards will permit their application to geothermal wastes. The control of particulates illustrates this potential problem.

In the most common particulate emission standard in the geothermal states, particulate emissions are calculated on the basis of process weight per hour. While process weight can be interpreted to mean the water or steam input into a geothermal electric generating unit, for example, enforcement probably would be difficult. Some of the state standards exclude liquid or gaseous fuel from the weight calculation, and Wyoming expressly excludes all water and steam.

The present environmental control situation for the geothermal industry is by no means static, however, in view of mechanisms at the Federal, state, and local levels of government which permit them to adopt new standards and to develop new industrywide restrictions.

Geothermal Statutes and Regulations

The state statutes and regulations adopted for the purpose of guiding geothermal development provide for leasing and/or conservation programs. They commonly require the use of drilling procedures, equipment, and fluids which will prevent entry of the geothermal resource into groundwater and also prevent blowouts. Advance notice is required of the intent to drill, redrill an abandoned well, deepen a well, plug, alter or remove casing, or convert a producing well to an injection well. A permit is sometimes required for these activities.

In some cases, directional drilling is prohibited, and, in others, distance from the property line requirements are adjusted to accommodate directional drilling. Well-spacing is often regulated.

Most of the regulations mandate any action necessary to prevent soil erosion, pollution of surface or groundwater, air and noise pollution, and hazards to public health and safety. It is frequently required that methods for achieving these steps be spelled out in a plan of operation. Noise associated with air drilling, and odors, must be minimized.

State NEPA-Type Statutes and Regulations

Several geothermal states have adopted statutes which are analogous to the National Environmental Policy Act. These include California, Hawaii, Montana, Nevada, Utah, and Washington. Others which do not yet have such a law engage in some type of agency review of proposed actions. These include Alaska, Arizona, Colorado, Oregon, and Texas.

The California Environmental Quality Act of 1970 and the guidelines for implementing it are probably as comprehensive as any state documents of this type. Geothermal activity becomes subject to their provisions by virtue of the fact that it falls within the definition of "discretionary projects" which require an environmental impact report if they have a potential for significant environmental effect. The definition of such effects includes several environmental impacts which may accompany geothermal development, such as the possibility of contaminating a public water supply system or adversely affecting groundwater.

The Act and guidelines were blamed for several years for inordinately delaying expansion at The Geysers, but California's "one stop" permitting process is working relatively expeditiously now. The guidelines undertake to avoid duplication of environmental evaluations by: (1) requiring only one report for individual projects which are part of a total undertaking, and (2) accepting, under certain conditions, impact statements prepared pursuant to NEPA.

Air Pollution

Many of the provisions of the air pollution regulations of 14 states and four California air pollution control districts (APCD) are similar to each other and identical in some cases. This similarity leads to the conclusion that potential geothermal developers are not likely to find a state which is an air pollution control "haven," so to speak, and this conclusion is supported by the fact that the history of enviromental regulation indicates very strongly that what one state imposes today may very well be adopted by another tomorrow. This factor is not as important to geothermal users as it might be to others since they have to operate where the resource is.

All states require some form of permit for the construction, modification, and operation of sources or potential sources of air pollution and a similar process for existing sources. The information required is usually quite comprehensive, and some of it, such as emission character and control equipment efficiencies, will be difficult for geothermal applicants due to lack of experience. Most regulations provide for variances conditional on unreasonable hardship.

Odor will be a troublesome characteristic for the control agency and the geothermal operator alike. These standards range from very general requirements to flat prohibitions -- neither of which is conducive to enforcement -- to such specific limitations that compliance will be difficult. A few are based on detectability after a prescribed number of dilutions with odor-free air.

Particulate Standards--

The most common particulate standard in the geothermal states has the effect of limiting the emission rate of particulate matter to 1.23 kg (2.75 lb) for the first 450 kg (1,000 lb) of process weight per hour, with limits up to 31 kg (69 lb) at 450,000 kg (1,000,000 lb) process weight per hour. This standard is employed in Idaho, Nevada, Montana, Oregon, for existing sources in Wyoming, Arizona for areas outside Phoenix and Tucson, and the four California APCD's in which Lake, Mendocino, Sonoma, and Imperial Counties are located. Other states use the same standard in a somewhat more stringent form. Some state agencies have indicated that it will not be applicable to geothermal operations except to industrial uses in which raw materials are processed.

Another type of particulate control is a limitation on the opacity of a plume which is No. 1 Ringelmann in most states surveyed. It is important to note that in most cases opacity which exceeds the standard because of the presence of uncombined water or condensing water vapor is not a violation. This is an especially important exception to geothermal operations because geothermal plumes are condensed vapor.

The particulate regulation applied specifically to geothermal steam operations by the Air Pollution Control Districts in the California North Coast Air Basin, which encompasses The Geysers, prohibits particulate discharges in excess of the quantity established by the following formula:

$$y = .00069x + 1.4$$

> where y is the particulate emission rate limitation in kilograms per hour (average over one hour) and x is the steam rate in kilograms per hour passing through a geothermal well drilling operation or a geothermal well being vented for clean out.

Sulfur Dioxide Standards--

Several of the states surveyed have no SO_2 emission standards applicable to geothermal operations because the standards relate only to the combustion of fuel or to specific industries. Those states include Colorado, Hawaii, Idaho, Louisiana, Montana, New Mexico, Oregon, and

Wyoming. The emission limitations of other states range from 1,333,500 μg/m^3 (500 ppm) to 5,334,000 μg/m^3 (2,000 ppm).

The values of Hawaii's ambient air standard for sulfur dioxide are considerably more stringent than those of the Federal standard -- i.e., an annual mean limitation of 20 μg/m^3 (0.008 ppm) as opposed to 80 μg/m^3 (0.03 ppm). Some of the other states employ lower values than the Federal standards, but Hawaii's is by far the most restrictive.

Hydrogen Sulfide Standards--

Four of the 15 states have an H_2S ambient air standard, two have promulgated H_2S emission standards, and three others have some type of standard on total reduced sulfur compounds. The values in these standards range widely and are accompanied by complex qualifications in some cases. They are tabulated in Section V of this report.

In addition, the California North Coast Air Basin APCD's have recently revised their hydrogen sulfide regulations applicable to geothermal steam power plants and to steam transmission line stacking, well drilling, reworking, and testing, and small source emissions. Those for power plants apply only to specific units at The Geysers while the others are generally applicable throughout the North Coast Air Basin. A range of limitations is currently applied to the various Geysers units, depending on when they were built or permitted, although all 12 units must meet a 200 gram-per-hour per gross megawatt limitation by 1986.

The limits on steam transmission line stacking (venting steam, through mufflers, for short periods when a turbine is shut down), are similarly staged through 1986. Emissions from well drilling, reworking, and testing are restricted to 2.5 kg/hr/well unless a higher rate is considered justified by the APCD. Small sources, defined as continuous well and pipeline bleeds, graduate down from the current 2.0 kg/hr/sources to 1.0 kg/hr on June 1, 1984, to 0.5 kg/hr on January 1, 1985.

Sulfuric Acid Mist Standards--

Standards governing the emission of sulfuric acid mist are significant to this study because this substance could be formed in the oxidation of H_2S in power production operations, creating a problem in the vicinity.

The Idaho ambient air quality standards applicable to sulfuric acid mist are as follows:

Primary and secondary standards: Max. 24-hr. concentration - 12 μg/m^3 not to be exceeded more than once/month

Max. 1-hr. concentration - 30 μg/m^3 not to be exceeded more than twice/week.

The Louisiana values for sulfuric acid mist, sulfur trioxide, and any combination thereof are very similar. Sulfur trioxide combines with moisture in the air to form sulfuric acid mist.

Water Quality

State water quality standards consist of criteria adequate to support designated uses. The criteria place limits on the concentrations of various parameters and restrictions on changes in pH, temperature, or other characteristics of surface water which, if not exceeded, will achieve the desired quality.

Most state waters are classified according to use. Classifications may include entire water bodies or may vary from reach to reach of the same stream. The criteria vary in stringency according to the degree of purity required for the designated classification of use. The values may be more restrictive than the Federal criteria if a state so desires.

The most recent Federal criteria are those for 65 toxic pollutants, and the limits for some of them are so low that they are expressed in nanograms (billionths of a gram). The pollutants on the list of most concern to the geothermal community are heavy metals such as arsenic, cadmium, chromium, copper, lead, mercury, selenium, and zinc.

Other constituents which are the subject of Federal criteria include beryllium, boron, hydrogen sulfide, iron, manganese, nickel, nitrate nitrogen, dissolved solids and salinity, and total dissolved gases.

Most state water pollution control regulations contain an antidegradation requirement that waters whose quality exceeds the standards will be maintained at their existing high quality. They are also likely to include a requirement that, water quality standards notwithstanding, technology-based limits must be complied with even if not necessary to achieve or maintain the applicable water quality standard.

There is a range in thermal standards among the 15 states, and even within states, where both warm water and cold water fisheries must be considered. There may also be differences in standards between fresh waters and estuarine and coastal waters; between streams and lakes; between use classifications; or between seasons of the year. For example, the maximum permissible increase in surface water temperature is commonly set at 2.8°C (5.0°F), but the states often set a lower maximum allowable rise for certain specified waters:

State	Water	Allowable Rise
Alaska	Cold	1.1°C (2.0°F)
Louisiana	Lakes & reservoirs	1.7°C (3.0°F)
Louisiana	Estuarine & coastal waters (Oct.-May)	2.2°C (4.0°F)
Louisiana	Estuarine & coastal waters (June-Sept.)	0.83°C (1.5°F)

Texas	Tidal reaches & other coastal areas (fall, winter, & spring)	2.2°C (4.0°F)
Texas	Tidal reaches & other coastal areas (summer)	0.83°C (1.5°F)

The most stringent temperature limitation found is "no measurable increase" which, in at least one case, is interpreted as 0.3°C (0.5°F), but in others it means no change at all. This usually applies to waters of the highest use classification, although the State of Washington applies it to all lakes. The temperature standards applicable to fresh water streams and marine waters in Washington are calculated on the basis of equations and will vary from water body to water body. Oregon places an 0.3°C (0.5°F) limit on changes incurred from one single source in waters of 17.5°C (63.5°F) or less, and a 1.1°C (2.0°F) limit from all combined sources when the water temperature is 16.7°C (62.0°F) or less.

The turbidity standards range from no increase in some of the higher use classifications up to a level which will not cause water turbidities to exceed 50 Jackson Turbidity Units. In some cases, higher permissible values are given for warm waters, and lower values are applied to cold waters.

Disposal of Waste on Land

The states are currently developing their programs to respond to the two major thrusts of the Resource Conservation and Recovery Act (RCRA). These thrusts are 1) the phase-out of open dumps for disposal of non-hazardous solid wastes, and 2) the management of hazardous wastes from the point of their generation to their disposal or treatment to a nonhazardous condition.

As noted earlier (p.7) geothermal solid wastes are currently exempted from the hazardous classification under RCRA. They are still subject to the provisions of the Act, however, that deal with non-hazardous wastes.

Noise Regulation

Five of the surveyed states reported existing environmental noise statutes. These states are California, Colorado, Hawaii, Oregon, and Washington. Hawaii, Oregon, and Washington have implementing regulations, and California requires counties to include a noise control element in their general plans.

The noise standards contained in the Colorado statute and the regulations of the other three states can be summarized as follows:

State	Zone	Daytime* dB(A)	Nighttime* dB(A)
Colorado	Residential	55	50
Hawaii	"	55	45

Washington	"	60	50
Colorado	Commercial	60	55
Hawaii	"	60	50
Washington	"	65	55
Colorado	Industrial	80	75
Hawaii	"	70	70
Washington	"	70	60
Oregon	All except	55-75	50-60
Oregon	Quiet Zones (wilderness areas, parks, etc.)	50-60	45-55

*These are variously set at 7:00 a.m. - 7:00 p.m. and 7:00 p.m. to 7:00 a.m.; 7:00 a.m. - 10:00 p.m. and 10:00 p.m. - 7:00 a.m.

There are a number of qualifications to these regulations which, for example, permit the prescribed limits to be exceeded for a given period during any hour; which limit noise of construction to specific hours; or which mandate muffling of construction equipment which exhausts air or gas.

COUNTY GEOTHERMAL ORDINANCES AND REGULATIONS

The county regulations designed to govern geothermal activities most often require a use permit, and the criteria for granting or not granting the permit is the area of most variability among them. Sonoma County, California, however, does not require such a permit for geothermal operations except on reserved agricultural lands where actual extraction requires a permit. The regulations of Napa County, California, embrace the most restrictive criteria encountered throughout the study.

A geothermal element of the county's general plan has been developed in Imperial County, California, which makes the county eligible for the lead agency role for assessing the potential environmental impact of all phases of geothermal development under the California Environmental Quality Act. Imperial, Plumas, and Lake Counties in California and Malheur County in Oregon employ very specific noise limitations.

The issuance of a Plumas County special use permit to applicants desiring to utilize the geothermal resource does not commit the county to future development of the geothermal field, if a field is identified by the permittee. Approval of development depends on review of extensive information on the character of the field supplied when testing is completed. If field development is permitted, a closed production system will be required for a fluid phase geothermal system or a minimum of 80 percent spent fluid injection system for a gaseous phase system.

SECTION II

OVERVIEW OF ENVIRONMENTAL REQUIREMENTS ATTENDANT TO GEOTHERMAL DEVELOPMENT

COMPARISON WITH REQUIREMENTS IMPOSED ON OTHER MINERAL PRODUCTION

Most of the land in the western states addressed in this report, with the exception of that in Hawaii, Louisiana, and Texas, is owned by the Federal government. The land is categorized in several ways and is administered by several different agencies. However, the largest acreages are in the so-called "public lands," which have never been in any other ownership, and the National Forests. The former are administered by the Bureau of Land Management in the Department of the Interior, and the latter, as indicated by their title, are under the control of the U.S. Forest Service in the Department of Agriculture.

In turn, the vast majority of the hydrothermal resources of the west underlie these lands, and, as is the case with other resources, these reservoirs can only be tapped by leasing the surface of the land from the appropriate surface management agency -- i.e., BLM or the Forest Service. Thus, the environmental controls imposed by these agencies, and the U.S. Minerals Management Service, which supervises operations on leased land, are of paramount concern in geothermal development.

It was therefore of considerable significance that the Geothermal Steam Act of 1970 (P.L. 91-581), which provides the sole authority for leasing public lands and National Forest land for geothermal exploitation, emerged from Congress as a single-purpose piece of legislation. While the original intent had been to expand coverage of the broader Mineral Leasing Act of 1920 to include geothermal, this amendment failed after a decade of congressional/executive branch disputes over issues unrelated to environmental concerns. A primary result of enacting separate authority for geothermal development was, however, that the final version included the first blanket authority for environmental protection ever applied to the exploration for and production and use of a resource on Federal lands. This provision is incorporated in the authority given to the Secretary of the Interior to prescribe rules and regulations to implement the Act; his authority to protect water quality and other environmental qualities is without limitation.

Passage of the Steam Act followed very closely behind enactment of the National Environmental Policy Act of 1969 (NEPA)(P.L. 91-190) and was the first major program to be developed in the Department of the Interior responsive to the requirements of NEPA. As a result, regulations were promulgated which are also unique in the mineral development/environmental protection interface and established what the Department then considered a pilot program of environmental control in the leasing of public lands. The regulations (Title 30 CFR Parts 270 and 271 and Title 43 Parts 3000 and 3200), and related special orders, called Geothermal Resources Operational Orders, for the first time applied to Federal lessees the full force of compliance with all applicable Federal, state, and local environmental standards and any more stringent standards which the Geological Survey Area Geothermal Supervisor (now Minerals Management Service Deputy Minerals Manager for Geothermal) may impose. This mandate includes control of all forms of air, land, water, and noise pollution, including but not limited to the control of erosion and the disposal of liquid, solid, and gaseous wastes.

In addition, the regulations require the Bureau of Land Management, and/or the Forest Service, to review the potential environmental impact of every geothermal lease issued and, until very recently an environmental analysis was required by the Geological Survey (now MMS) of every proposed action on the leased land. Each succeeding well to be drilled -- exploratory, development, production, or injection -- was subjected to this kind of scrutiny if it was not included in a previously-approved plan of operation.

These very specific and all-inclusive requirements offer a sharp contrast to the related language in the regulations which implement the Mineral Leasing Act under which oil and gas lessees operate on Federal lands (Title 43 CFR Part 3000). The latter regulations, written much earlier, set forth special stipulations to be attached to oil and gas leases which require a plan of operation which, in turn, must include methods to be "used to assure the disposition of drilling mud, pollutants, and other debris." Environmentally acceptable methods of disposition are not mandated. The stipulations go on to require "all things reasonably necessary to prevent or reduce" to the fullest extent scarring and erosion of the land, pollution of water resources, and damage to the watershed. The lessee is obligated to repair such damage and to take such corrective measures to prevent future occurrences as are deemed necessary by the Department. Other restrictions are oriented almost exclusively to the protection of wildlife and no reference is made to air pollution, noise, or other ecological parameters.

The environmental protection features developed for the geothermal program have not been applied to the other mineral programs. In fact, in a final appendix to the Department of the Interior's NEPA procedures for the Bureau of Land Management (Federal Register, 15 December 1980), issuance of upland oil and gas leases (as opposed to off-shore) is established as a categorical exclusion from the NEPA process. In actuality, this does not change what has been normal practice. The exclusion is based upon the assumption that, after the drilling of thousands of oil and gas exploratory and production wells, their adverse impacts are well known and predictable and can be mitigated or eliminated through stipulations on operations in the lease. Environmental consideration will probably still be given to oil and gas leases in sensitive areas or where the public interest demands it.

Geothermal non-competitive leases apparently will soon be added to the list of categorical exemptions, and it is expected that competitive leases may follow at a later date. The two are being treated separately since development is much more likely to occur on competitive leases that theoretically lie on more promising known geothermal resource areas (KGRA's) designated in conformance with the Geothermal Steam Act.

In the case of non-competitive geothermal leases, surface disturbance occurs on only about one in 10, and drilling activity is considerably more rare. As a result, a great deal of effort and funds have been spent by BLM and the Forest Service to evaluate the impact of full development, through to power plant construction and operation, which has yet to occur on non-competitive lands.

Recent revisions to the Department's NEPA procedures for the Minerals Management Service (Federal Register, 23 January 1981) also classify several post-lease geothermal permitting procedures as categorical exclusions, thus reducing paperwork and potential delay. These include:

- approval of geophysical exploration for geothermal resources
- approval of a plan of operation for geothermal exploration or development when an environmental document has been prepared at the leasing stage
- approval of a plan for geothermal production when derived from a plan of utilization which has been covered by an environmental document
- approval of a plan for injection of geothermal fluids meeting the requirements of Geothermal Resources Order No. 4, discussed in Section IV of this report.

Currently, the Department of the Interior is developing regulations to reflect remedial changes in the geothermal leasing program recommended by the Interagency Geothermal Streamlining Task Force in January 1979 (2) and legislation is under consideration by Congress to deal with the recommendations which require changes in the Geothermal Steam Act before they can be implemented. It now appears that Congress will not amend the Geothermal Steam Act until 1983 at the earliest. The Forest Service is also undertaking to expedite lease issuance on the land it controls, but due to the nature of the forests, competing interests are making this change very difficult.

Overall, it appears that the dissimilarities in treatment of oil and gas activities on the one hand and geothermal operations on the other are beginning to break down. Dissimilarities have been exemplified by oil and gas leases being issued with no or very little delay while geothermal applicants are still awaiting leases on applications filed as early as January, 1974, the first month the program was in operation. Many potential geothermal developers have been discouraged by the long delays involved.

This discussion has been limited to the public lands and forest lands since other categories of Federal lands available for geothermal leasing are relatively small in size. Geothermal development is precluded by the Steam Act in national parks, national recreational areas, fish hatcheries, wildlife refuges and ranges, game ranges, wildlife management areas, waterfowl protection areas, lands acquired or reserved for protection and conservation of fish and wildlife threatened with extinction, and Indian and restricted lands. All mineral development will also be prohibited in the lands designated as wilderness areas under the Wilderness Act of 1964 (P.L. 88-577) as of 1 January 1984.

Geothermal development on Indian lands is administered by the Tribal Council with Bureau of Indian Affairs approval. Regulations for this activity are found in 25 CFR. Very few leases have so far been issued under this mechanism.

OTHER FEDERAL GEOTHERMAL LEGISLATION

When the Department of Energy (DOE) was created in 1977 (P.L. 95-91), authority to promulgate regulations on certain aspects of geothermal leasing was transferred to the new department from the Department of the Interior (DOI). These included fostering of competition for leases, implementation of alternative bidding systems, and other features. This authority has never been implemented, and DOI's sole responsibility for issuing and supervising leases has remained intact.

The functions of the Energy Research and Development Administration, created by the Energy Reorganization Act of 1974 (P.L. 93-438), were absorbed into DOE and geothermal energy development responsibilities have since been administered by its Division of Geothermal Energy. The basic authority for the Division's functions are contained in the Geothermal Energy Research, Development, and Demonstration Act of 1974 (P.L. 93-410). The Division's programs include technology research and development, removal of institutional barriers to geothermal development, dovetailing of environmental laws, planning for commercialization of the resource, and related functions.

The Energy Supply and Environment Coordination Act (P.L. 93-319) was designed to "provide a means to assist in meeting the essential needs of the United States for fuels in a manner which is consistent...with existing national commitments to protect and improve the environment..." Its focus, however, was exclusively on the use of coal as a replacement for oil and gas.

EFFECT OF OTHER FEDERAL STATUTES ON LEASE ISSUANCE AND LEASE STIPULATIONS

Depending on the character and resources of a specific area, leases may be denied on the basis of the requirements of various natural resource statutes or leases may be issued conditioned on stipulations (e.g., limitations imposed on the timing and location of various operations) designed to protect the interests governed by those statutes. Some of them include:

Fish and Wildlife Coordination Act
Coastal Zone Management Act of 1972
Wild and Scenic Rivers Act of 1969
Endangered Species Preservation Act of 1966
The National Historical Preservation Act of 1974
Archaeological and Historic Preservation Act of 1964

Up to the present, environmental considerations have engendered only about seven percent of the total rejections of non-competitive lease applications, those on lands not within the KGRA's. There are no figures available on the KGRA acreage which has been withheld from lease sale because of the above statutes.

GEOTHERMAL-SPECIFIC STATUTES AND ORDINANCES AT THE STATE AND LOCAL LEVEL

Fourteen of the states subject to this survey, and several counties, have adopted statutes providing for the development of geothermal energy within their borders. Just as the U.S. Congress had the option to extend coverage of existing legislation to geothermal, so, too, did these states and local jurisdictions. All of them appear to have selected the single-purpose route, however. The states with such statutes include:

Alaska
Arizona
California
Colorado
Hawaii
Idaho
Louisiana
Montana
Nevada
New Mexico
Oregon
Texas
Utah
Washington

As discussed in Section V, Wyoming is currenty developing a geothermal statute.

The separation of the geothermal provisions from those governing oil and gas leasing and production into single-purpose legislation was not motivated so far as is known by a desire to strengthen controls on misuse of the environment. However, this action appears to have had that result, whether or not it was planned.

It may be that this additional layer of environmental control will not be considered necessary in view of the existing interweave of legal environmental requirements at the Federal, state, and local levels which apply to all sources of pollution. The mechanism is nevertheless there for those jurisdictions which choose to utilize it. And, before deciding that it is not needed, consideration may be in order as to whether existing regulations and standards designed to abate the pollution generated by dissimilar pollution sources are indeed applicable to the processes of this industry. This subject is addressed later in Sections III and V.

All of the state statutes which provide for leasing of lands for geothermal development apply, of course, only to state-owned lands. Others -- such as those dealing with resource conservation and drilling regulation -- usually apply to all lands within the state. Statutes of Arizona, California, Colorado, New Mexico, Oregon, Texas, and Washington appear to fall in the latter category although most of these states also have a geothermal leasing statute.

The states have, to a large extent, patterned their geothermal laws very much after those related to oil and gas. They have adopted regulations implementing their geothermal statutes, and some of them spell out very detailed environmentally-oriented requirements, although they generally stop short of numerical standards on pollution parameters, except in some cases, for noise and odors. Most of the regulations also contain highly specific drilling requirements.

GENERAL ENVIRONMENTAL CONTROL REQUIREMENTS

In addition to those dealing specifically with geothermal development, there are Federal, state, and county laws and regulations which are generally applicable to all sources of pollution or potential sources. Some of the geothermal regulations specifically reference the air, water, noise, or other environmental standards with which compliance is required, and others simply require blanket compliance with all applicable standards. Reference to geothermal wastes, as such, in the general environmental control documents is, as yet, rare. Exceptions are (1) the current exemption in the Resource Conservation and Recovery Act from classifying geothermal wastes as hazardous, and (2) the classification of geothermal injection wells as Class V in the Underground Injection Control Program regulations under the Safe Drinking Water Act.

SECTION III

ANALYSIS OF FEDERAL/STATE POLLUTION CONTROL REQUIREMENTS

The major thrust of this section is the uncertainty which surrounds the environmental control requirements with which the emerging geothermal industry will be called upon to comply. It points up the sparsity of existing numerical standards which relate to the anticipated waste parameters of geothermal operations. Section V in turn raises the further question of whether, indeed, some of the existing numerical limitations are suitable for application to geothermal operations which involve neither combustion nor materials other than water or steam and associated pollutants.

As discussed previously, geothermal operations on Federal land are subject to compliance with all applicable Federal, state, and local environmental control standards dealing with air, land, water, and noise. The word "standards" is interpreted here to mean all applicable statutes and regulations. Specific standards on various parameters are, of course, the heart of environmental regulations and the form of regulation in this field which is most easily enforced.

Geothermal operations on state and private lands are also subject to Federal, state, and local standards. This is because general, across-the-board pollution control regulations apply to all sources or potential sources of pollution whether or not states specifically reference the standards in geothermal statutes or regulations.

This section of the report analyzes Federal pollution control requirements and state requirements which are necessitated by Federal legislation. It also presents general discussions of erosion control and subsidence regulation at the Federal and/or state level although interplay between the two levels in these areas is not specifically mandated.

In many cases, the state air and water pollution control documents do not go much further than the performance required of them by Federal law. This section deals only with the broad interaction between the two levels in these areas; specific state standards are discussed in Section V.

CONSOLIDATED PERMIT REGULATIONS

EPA has published regulations (40 CFR Parts 122, 123, 124, and 125, Federal Register, 19 May 1980) designed to consolidate the permitting procedures for five major programs. They include:

- Prevention of Significant Deterioration under the Clean Air Act
- Underground Injection Control under the Safe Drinking Water Act
- National Pollutant Discharge Elimination System under the Clean Water Act
- Hazardous Waste Management under the Resource Conservation and Recovery Act
- State Dredge and Fill under the Clean Water Act

All but one of these programs are discussed separately below and the technical regulations for each one are cited. The dredge and fill program is omitted because this type of permit will only be needed when plant construction involves dredge and fill activities for water intakes or other structures and has no real bearing on the use of geothermal energy.

The consolidated regulations are procedural in nature and are intended to ease the permitting burden on applicants whose proposed construction requires more than one kind of permit and to accelerate the time required to obtain all necessary permits. It represents the "one-stop-shopping" permitting concept.

AIR POLLUTION CONTROL

The primary, if indirect, objective of the Federal Clean Air Act is the imposition of limitations on the emissions of air pollutants from both stationary and mobile sources. This discussion is limited to stationary sources only.

The mechanisms prescribed in the Act for establishing emission limitations are set in motion at the Federal level. However, with only a few exceptions the numerical emission standards are set by the states.

Air Quality Criteria/Ambient Air Quality Standards/State Emission Standards

The first procedure outlined in the Act with the ultimate objective of emission standards begins with the issuance of air quality criteria on pollutants which in the judgment of the EPA Administrator have an adverse effect on public health and welfare. The criteria undertake to identify scientifically the kind and extent of all effects on health or welfare which may be expected from the presence of a given pollutant in the ambient air, in varying quantities, and under various conditions.

The Administrator is then directed to promulgate both a national primary and secondary ambient air quality standard for the pollutant. Primary standards are geared to protect public health and secondary standards are designed to protect public welfare. ("Welfare" is interpreted to mean effects on soils, water, vegetation, materials, economic values, and personal well-being, among others.)

Ambient air standards are goals for what is considered acceptable air quality in a given area. They are designed to reflect the causative relationship between the level and degree of pollution and the degree of its effects, and, in some cases, a time element.

Emission standards limit the allowable amount of pollutants which may legally enter the atmosphere from a given source. They are calculated at levels which theoretically will permit the ambient air standards to be achieved, taking into account air quality and meteorological considerations. This statement is too simplistic where a density of sources is involved, but this is not expected to be a problem in geothermal production. Emission standards are enforceable and are the primary regulatory control tool of interest to the emerging geothermal industry.

Once an ambient air standard is set, the Clean Air Act requires the states to adopt a plan to implement the standard. This plan, called a state implementation plan, or SIP, must include an emission standard for the pollutant.

Ambient air standards have been established for seven pollutants as follows:

- sulfur dioxide
- particulate matter
- ozone
- hydrocarbons (excluding methane)
- carbon monoxide
- nitrogen oxides
- lead

Federal Emission Standards

In general, the Clean Air Act requires EPA itself to establish three major types of emission standards. These standards include: (1) new source performance standards (NSPS); (2) national emission standards for hazardous air pollutants; and (3) emission standards imposed by EPA when a state fails to adopt its own emission standards or its standards are deemed inadequate.

The first of these is the one likely to be of major concern to geothermal operations. This is true first because, based on what is known today about the probable air pollutants associated with geothermal production and their concentrations, this type of activity will not be a source of "hazardous" pollutants in the context of the Act. "Hazardous" pollutant is defined as one which in the judgment of the EPA Administrator may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness. It is not anticipated that levels of hydrogen sulfide, mercury, ammonia, or radon, four of the more widely present contaminants in geothermal fluids, will meet this criterion although topographic and meteorologic conditions could possibly engender hazardous levels sporadically in some cases.

Second, any emission standards imposed by EPA in the absence of state action would probably fall within the numerical limitations adopted by other states and approved by EPA. Thus, no requirements substantially different from those of neighboring states would be expected through the NSPS route. In addition, emission limits via this route would involve criteria pollutants only. None of the above named pollutants has been designated a criteria pollutant.

The new source standards of performance impose restrictions on quantities of pollutant emissions. However, they are different in character from other emission standards in that they are designed to reflect the best demonstrated technology taking costs into account, and, contrary to the purposes of other emission limitations, are not calculated to achieve any specific air quality levels.

Once an NSPS is established for a pollutant for which no air quality criteria have been issued, Section 111 of the Clean Air Act requires the states to set emission standards for existing sources of such a pollutant in the same category as the new sources for which an NSPS is set. These standards are not required to be more stringent than the NSPS, but since the states are not preempted from more stringent regulations on stationary sources, this possibility always exists. Thus, when, or if, EPA establishes NSPS applicable to geothermal wells and attendant activities, this action will not only affect all future geothermal development, but would affect existing operations as well, potentially more so, depending on the pollutants regulated.

There are three other types of emission regulation which might be termed specialized standards in that they apply only in designated areas. These include:

BACT - Best Available Control Technology
LAER - Lowest Achievable Emission Rate
Increments - Limitations on emissions which will not cause ambient levels of a pollutant to exceed an allowable increase over baseline levels.

BACT is applicable in areas designated as PSD areas, discussed below, and takes into account the energy, environmental, and cost factors and the benefit of emission reduction achievable with each available technology. The emission limitations then specified are those that reflect the maximum degree of reduction for each regulated pollutant to be emitted. If the permitting authority determines there is no economically reasonable or technologically feasible means to accurately measure the emissions and thus to enforce an emission standard, the proposed source may be required to design and use alternative equipment, work practices, and operational standards to reduce emissions to the maximum extent.

LAER is applicable in areas which have not attained one or more air quality standards, and is designed to force the use of technology which is achievable in practice. This level of control must reflect 1) the most stringent emission limitation in the state's implementation plan for the pertinent category of sources unless the applicant can demonstrate that such limitations are not achievable in his proposed operation; or 2) the most stringent emission limitation which is achievable in practice within the industrial category, whichever is more stringent.

An increment, another PSD control tool, is in one sense an ambient air standard in that the allowable increase of a pollutant is expressed as an increase of ambient concentrations. Emissions are limited indirectly in that they cannot permit the increment to be violated.

State Emission Standards vis-a-vis NSPS

In recent years, the new source performance standard has been the dominant route for mandating state emission standards. Only one new ambient air quality standard -- the one for lead -- has been promulgated since the other six were adopted as a package in the early 1970's, and that one was set only in response to a court order. In the meantime, NSPS have been continually in development for various industries, or segments of industries.

There is currently no criterion or ambient air quality standard for hydrogen sulfide. While H_2S is a regulated pollutant for PSD purposes, the significance of which is discussed below, the states are not required to set general emission standards on this pollutant, and few have done so. As a regulated pollutant, it would be a likely early candidate for a criterion and standard and, in turn, mandated state emission limitations.

Any EPA action on an NSPS geared to geothermal production and use would likely depend on how soon this industrial activity becomes a potential major source of air pollutants, the nature of the pollutants generated, degree of overt public concern, and EPA's backlog in promulgating standards of performance. In view of the fact that NSPS have not yet been promulgated for a number of established industries encompassing many polluting sources, it appears that geothermal wells and utilization facilities would have to be granted very high priority to be subjected to NSPS in the near future.

Problems in Establishing NSPS for Geothermal

While the backlog of NSPS is gradually being reduced, it still exists largely because the selection of standards of performance to achieve the intent of Congress has been surprisingly difficult, according to EPA reports, and due to the limited geothermal experience, the task is likely to be even more difficult for this source. In general, the standards must: (1) realistically reflect best demonstrated control practice and consider the cost of such control; (2) apply to modifications at existing sources as well as new installations; and (3) meet these conditions for all variations of operating conditions under consideration anywhere in the country. In light of the very wide variation in the nature of geothermal resources, the latter criterion is formidable at best.

A major step in developing NSPS is identification of the best system of emission reduction which "has been adequately demonstrated" and quantifying the emission rates achievable with the system. EPA interprets the legislative history of Section 111 of the Clean Air Act and various court decisions to mean that the Administrator's judgment of what is adequately demonstrated is not limited to systems that are in actual routine use. Consequently, he may consider control systems which have been adequately demonstrated but for which there is limited operational experience, or control systems used on other types of sources that, in EPA's judgement, can be applied to the source category in question. To date, the Agency has based its determination of the "degree of emission limitation achievable" primarily on results of tests of emissions from existing sources. In some cases, this has required investigation of emissions from control systems in other countries where more effective systems of control than those in the United States are employed. This is also a possibility when attention is focused on geothermal production.

When the best demonstrated systems of emission reduction are not in widespread use, the data base upon which the standards are established will necessarily be somewhat limited. This is certain to be a problem with geothermal production and use, and EPA's common starting point -- test data on existing well-controlled sources -- is likely to be limited as well, especially in view of the wide variation in geothermal formations, as noted above, and production and use techniques. Since the control of existing wells and utilization facilities will represent retrofit technology in most cases or technology designed to meet an existing state or local regulation, EPA may decide that new wells can meet more stringent emission limitations.

Prevention of Significant Deterioration Regulations

The prevention of significant deterioration in the air quality of "clean" air areas is a relatively new concept in air pollution control. It is commonly referred to as "PSD."

This concept grew out of the goal enunciated, but not provided for, in early air pollution control legislation "to protect and enhance" the Nation's air quality. After several years of controversy and litigation over whether EPA had the statutory authority or duty to enforce higher levels of protection than those afforded by maintenance of the ambient air quality standards -- EPA felt that it did not -- the courts effectively held that the Agency was required to do so, and Congress adopted and elaborated this view in the 1977 Amendments to the Clean Air Act (P. L. 95-95, as amended by P. L. 95-190).

Congress essentially enacted the PSD concept as developed by EPA in regulations responding to the court-order mandate (40 CFR 52.21), finalized in December 1974. This is a reversal of roles in that the statute usually comes first and provides guidance for the implementing regulations. In this case, Congress accepted the basic regulatory approach, but made a number of changes.

EPA subsequently amended the earlier regulations to conform with those changes, and this version of PSD was also challenged in the courts (Alabama Power Co. et al. v. Costle, No. 78-1006, District of Columbia Circuit). As a result, the regulations have since undergone additional major revisions, being finalized in August 1980.

The basis of the PSD program is a permit system. The technical permit requirements and the minimum requirements for state-administered PSD programs are contained in 40 CFR Parts 51 and 52 (Federal Register, 7 August 1980). The procedures for obtaining a Federal PSD permit are set forth in 40 CFR Parts 52 and 124 (Federal Register, 19 May 1980 and 7 August 1980). EPA will implement PSD until states have established approved programs.

Since areas are designated as PSD areas on the basis that national ambient standards for any criteria pollutant have been attained, or that there is insufficient data to determine attainment or nonattainment, a PSD permit is required in many areas of the country, including the remote, primitive areas of the west where such a large bulk of the geothermal resource is located. In such areas, a new geothermal power plant with the potential to emit 250 tons per year or more of any regulated pollutant qualifies as a major stationary source and is subject to PSD. The cut-off point is 100 tons per year for certain industries enumerated in the regulations, and it is assumed that it would apply to those industries whether or not they use geothermal energy. The regulated pollutants of concern, insofar as the nature of geothermal resource is now known, are particulates, hydrogen sulfide, and, possibly, sulfur dioxide.

There are two qualifiers, however, in calculating PSD applicability. First, the 250-ton emission rate is that which will occur after the application of emission control equipment and operating limitations on such factors as hours of operation and quantitites of the resource utilized. Emission reductions must be enforceable to be credited.

Second, the term "source," as finally defined, may consider the facility using the geothermal resource as a separate source from the attendant well field producing the resource. This provision may reduce the number of geothermal facilities subject to PSD since each of the two sources will be permitted to emit up to 250 tons of controlled emissions of a regulated pollutant, or 100 tons as the case may be, before triggering PSD application.

Modifications to existing sources are also subject to PSD if they will result in a "significant net increase" in the emissions of a regulated pollutant. "Significant" is based on a table of de minimis levels of regulated pollutants, and "net" refers to an increase which is not offset by reductions in emissions of the same pollutant by the existing source. For example, if the construction of an additional power generating unit would increase the emissions of H_2S by 50 tons per year, even after contemporaneous reductions in H_2S emissions were effected for the existing power plant, it would qualify as a major modification and subject to PSD. If contemporaneous reductions in the original H_2S emission level result in a net increase of less than 10 tons of H_2S per year, the de minimis value, the additional unit is not a major modification and is not subject to PSD.

In order to obtain a PSD permit, major new stationary sources or modifications are subject to a new source review. The major elements of this review are:

- an analysis to determine best available control technology

This technology, described above, is always established on a case-by-case basis.

- an analysis of ambient air quality

This analysis, which may or may not involve monitoring for one or more pollutants over a time period specified on a case-by-case basis but generally a year by law, must demonstrate that the emissions of a major new source or modification will not violate an ambient air quality standard or an applicable "increment." As noted above, increment is the new PSD tool for allocating among new sources an allowable increase in the ambient concentrations of a pollutant above baseline concentrations. So far, the increment system applies only to particulates and sulfur dioxide. EPA is currently considering means for preventing the significant deterioration of air quality for the other criteria pollutants.

As part of the air quality analysis, the PSD permit applicant will be required to determine how much increment is available for any pollutant for which increments are established which his proposed facility will emit. If there is none, the permit cannot be issued until or unless an existing source(s) reduces emissions of the pollutant(s). For now, EPA will allocate increments on a first-come, first-served basis. The agency has recommended that the states examine alternative methods for allocation such as marketable permits, emission density zoning, and emission fees.

- an analysis of impacts to soils, vegetation, and visibility and associated impacts from commercial, residential, industrial, and other growth

The guidelines for performance of this type of analysis have not been formulated.

- determination of no impact on a Class I area

Class I areas are pristine areas such as national parks and designated wilderness areas which will be subject to the strictest degree of control under PSD. The permitted increments for sulfur dioxide and particulates are very small. In addition, if the emission of a proposed facility to be constructed outside a Class I area would adversely affect air quality related values (including visibility) of such an area, the cognizant Federal land manager may recommend denial of the PSD permit even though no allowable increment would be violated. Since geothermal development is already precluded from the lands classified as Class I, as discussed in Section II, it is the latter provision which may exert the greater impact on the use of this resource in some areas.

Except for the Federally-protected areas designated as mandatory Class I areas by P.L. 95-95, all areas of the country are designated as Class II, a classification which will permit moderate industrial growth. States and Indian tribes may undertake to reclassify Class II areas to Class I or Class III, the already-industrialized areas, although the latter procedure is complex and will require local political action.

In sum, the applicability of PSD to geothermal operations will hinge to a major extent on the amount of pollutants contained in the resource, the identity of the pollutants, and the size and type (open or closed system) of the operations. It is estimated that most, if not all, small direct users will not be subject to PSD, and that the more costly requirements of this system will be applied only to (1) large power plants or (2) large industrial uses, the emissions of which would fall under PSD with or without the use of geothermal energy.

Substantial changes in the PSD program are under consideration by Congress as this report is written.

Regulations applicable to nonattainment areas are not discussed here since they are not likely to have any particular effect on the pace of geothermal development in the foreseeable future. A new or modified major source is subject to nonattainment review only if its emissions will exceed the cutoff point for a pollutant for which the national ambient air quality standard has not been attained in an area. Unless this type of standard is set in the future for hydrogen sulfide, the standard for particulates would be the only one which might be violated by geothermal operations. The areas designated as nonattainment due to particulate levels are mostly urban, industrialized areas where geothermal activity is not anticipated. And, if H_2S becomes the subject of a standard, ambient levels in geothermal prospect areas could be expected to achieve the standard except near large naturally-occurring sources such as those in Yellowstone Park.

WATER POLLUTION CONTROL

The prevailing legislative control of surface water pollution is the Clean Water Act, P.L. 92-500, as it was amended by P.L. 95-217 in 1977. This voluminous law, and the hundreds of pages of new regulations it has engendered, impact almost any type of industrial activity, but its effects are, of course, more pronounced on the industries whose processes require the use of large volumes of water. The degree of its effects on geothermal enterprises will almost certainly vary with the form in which geothermal resources are manifested, the production technology utilized, the use to which the resource is put, the conditions imposed on injection of geothermal fluids, and to what extent injection is deemed a more attractive alternative than discharge to surface waters.

It is emphasized that all of the ensuing discussions of provisions of P.L. 92-500 are relevant only to surface discharge of pollutants. Injection to underground waters is regulated under the Safe Drinking Water Act, and is discussed below.

While the Clean Water Act requires interaction between the Federal program and the states, the mechanisms prescribed are somewhat different from those of the Clean Air Act. In one important area, implementation of the National Pollutant Discharge Elimination System (NPDES) permit program, state participation is voluntary. They are not required to manage this program under state law unless they desire to do so whereas implementation plans for air pollution control are considered mandatory -- i.e., EPA has an

NPDES program in operation which covers all states which elect not to operate their own program. If a state failed to develop an EPA-approved SIP, EPA would promulgate a plan for that state only.

The states which have qualifed to implement the NPDES program within their borders include several with geothermal resources such as California, Colorado, Hawaii, Montana, Nevada, Oregon, Washington, and Wyoming. More current information on the status of a given state in this regard may be ascertained through a state or local water pollution control agency.

All of the many ramifications of the Act and the regulations are not presented separately here. Instead, the potential broad, cumulative effect on geothermal development is analyzed.

Effluent Limitations Guidelines and New Source Performance Standards

EPA has promulgated effluent limitations guidelines applicable to the discharges of existing industrial facilities under Sections 301, 304, and 307 of the Clean Water Act, and new source performance standards (NSPS) under Section 306. These limitations and standards, referred to in this discussion as NSPS since the greatest applicability in the geothermal field will be to new facilities, are industry-specific, or, in many cases, specific only to a segment, or subcategory, of an industry. They are generally promulgated as single-value limitations on permissible discharges of specific constituents.

New sources within the industries covered by new source performance standards must achieve the greatest degree of pollutant reduction achievable through application of the best demonstrated technology, processes, operating methods, or other alternatives. The major classes of pollutants addressed are the toxic pollutants identified under Section 307 of the Act and the conventional pollutants which include biological oxygen demand (BOD), suspended solids, fecal coliform, pH, and oil and grease.

The toxic pollutants were the primary focus of the 1977 amendments, and EPA has identified a group of 65 pollutants as toxic waste water constituents. They are discussed in detail in Section V in connection with water quality criteria and standards.

None of the mandated considerations taken into account in the process of establishing the NSPS promulgated so far has included the use of geothermal steam or fluids as the source of energy in power generation or the manufacturing industries or for direct process use in the latter. Thus, there are no new source performance standards which specifically reference geothermal energy use. While the generation of power with geothermal energy was not specifically excluded from coverage of the NSPS applicable to fossil-fueled and nuclear power plants, these regulations do not, and were not intended, to apply to geothermal plants. In addition, there are clearly no standards which would apply to the effluents of district heating systems.

The applicability of the NSPS to industries such as pulp and paper mills and food processing of various types, in which geothermal energy could be used in their manufacturing processes, is not clear-cut. For the NSPS to be valid, they must be based on factors which are similar across the industrial segment to which they apply. However, there is no provision for a variance on the basis of fundamentally different factors under the Clean Water Act.

It may be that a ruling for applicability with a variance could be the most favorable interpretation for geothermal effluents from industrial uses. In that case, each plant would be operating on an equal basis with its competitors, a situation not shared by industries for which NSPS have not been set. Instead, the latter industries will be subjected to NSPS established on a case-by-case basis by the state agency administering the NPDES program or the EPA Regional Administrator. This results both in non-uniform standards among competitors and uncertainty as to what the limits will be.

The limitations imposed in this manner would still be technology-based where possible, but could be conditioned to a large extent on state water quality standards where necessary. These standards, discussed in detail in Section V, limit the allowable concentrations of pollutants in receiving streams, and the limits imposed on discharges must be sufficiently strict to maintain the standard. In some cases, this process may generate a stricter standard than EPA would find necessary to apply across-the-board to similar types of geothermal uses. This is because the states set very stringent standards for water bodies where they feel extra protection is desirable which, in turn, mandate stricter limits on effluent parameters. This situation can apply to facilities whether or not they are subject to NSPS since, under Section 302 and 303 of the Act, more stringent limits can be imposed on plants subject to such regulation if the applicable limits will not maintain the water quality standards.

In contrast to the concentration values of water quality standards, EPA has adopted for use in NSPS a pounds-per-unit-of-production value on most constituents in the wastes of product-oriented industries. This concept equalizes the limits among all sources in a category of sources regardless of size. The limits in the NSPS for electric power plants are, however, expressed in mg/l concentrations. Thus, it appears that the use to which geothermal energy is put may determine the form in which the NSPS are expressed.

Many of the promulgated effluent limitations have been contested in court by the affected industries, primarily on a point which will be highly significant when EPA undertakes to set limitations for geothermal production and use. The contention has been that an inadequate wastewater treatment performance data base was utilized to arrive at the numerical standards, and that they are thus not representative of or achievable by all sources in a category. While this situation arose in some established industries because of the limited number of treatment systems utilized to produce adequate data, it may occur in the geothermal industry both because the number of operations themselves is limited, and, up to now, there is virtually no wastewater treatment to provide data. EPA has attempted to overcome this latter kind of problem with the transfer of treatment technologies from related industries with similar waste characteristics. This, too, has been the subject of considerable controversy.

NPDES Permits

Under Section 402 of P.L. 92-500, pollutant discharges into the navigable waters of the country, the territorial sea, the waters of the contiguous zone, or the oceans without an NPDES permit are illegal with limited exceptions which are of no particular interest to the geothermal industry. Industrial wastes discharged to publicly owned treatment systems are exempt from NPDES provided that they are in compliance with pretreatment standards. These standards are discussed below.

Usually, the applicable effluent limitations guidelines or new source performance standards constitute the major conditions of the permit. In their absence, the permit conditions are derived on a case-by-case basis as discussed above.

A copy of a Federal NPDES permit application is shown in Appendix A to illustrate the kind of information which must be supplied. Permits issued by states are exemplified by the permit which the State of California issued to Union Oil Co. of California for waste discharges at The Geysers, the only geothermal field presently used for commercial electric power generation in this country. It is shown in Appendix B. The permit is entitled "Waste Discharge Requirements," the terminology used by the state for "permit." The discharge specifications of the permit: (1) prohibit the discharge of wastes of any nature to the waters of the nearby creek or its tributaries; (2) require the disposal of drilling muds, oils, and associated wastewater on a disposal site approved and classified by the regional water pollution control board; and (3) prohibit nuisance and pollution created by the treatment or disposal of waste. In addition, the permit provides that: (1) wastes produced in connection with site preparation and road construction will be placed where they cannot be reasonably expected to be carried to the creek or its tributaries; (2) all roads and exposed surfaces will be protected from erosion; and (3) the company will comply with a notification, monitoring, and reporting program. The Notification, Monitoring, and Reporting Program is shown in Appendix C. Such programs are authorized in the Federal NPDES permit regulations, Title 40 CFR, Part 122, Subpart D.

Environmental Impact Statements for New Source NPDES Permits

Section 511 of the Water Pollution Control Act applies the provisions of the National Environmental Policy Act of 1969 (NEPA) to the issuance, by EPA, of an NPDES permit for a new source of water pollution. However, the Water Pollution Control Act defines a new source as one on which construction is commenced after applicable new source performance standards are promulgated or proposed (if they become final in 120 days). Thus, geothermal operations for which there are no applicable NSPS are not yet subject to the Federal regulations implementing this provision of the Water Pollution Control Act (40 CFR Part 6). However, their requirements will constitute a significant environmental restraint on a young industry consisting almost entirely of new sources when or if EPA proposes new source performance standards for its operations. Thus, a brief description is included here.

These Section 511 regulations (40 CFR Part 6) are applicable only to new source permits issued by EPA and not to permits obtained under state programs. However, as discussed in Section V, some states have adopted NEPA-type statutes of their own which provide a mechanism for similar review of potential environmental impact.

The whole Federal procedure hinges on the initial decision as to whether a proposed facility is a "new source." Construction of a source on a site at which no other source is located or construction of a source which replaces or changes the nature of the discharges of an existing source on the site will be so classified unless at the time the NSPS is proposed/promulgated there has been no:

- placement, assembly, or installation of facilities or equipment
- significant site preparation work
- binding contractual obligation for the purchase of facilities or equipment which are intended to be used in its operation within a reasonable time.

If normal prudence is exercised in obtaining all applicable approvals, permits, licenses, etc., before committing funds to advanced development work, then under these guidelines nearly all future geothermal operations would be defined as new sources when they become subject to NSPS. In addition, existing state environmental impact reporting requirements do not generally limit their application to "new sources," but apply them across the board to actions which will significantly affect the environment.

Thus, it appears that most, if not all, proposed geothermal development may be subject either now or at some future point to NEPA-type scrutiny at the Federal or state level. This discussion is limited to the Federal regulations (40 CFR Part 6), and the state requirements are summarized in Section V.

In brief the major steps are:

- Potential new source applicant prepares an environmental information document (EID) of sufficient scope to enable EPA to prepare an environmental assessment.
- EPA conducts an environmental review or study of the proposed action described in the EID to identify and evaluate the related environmental impacts.
- EPA prepares an environmental assessment which is a public document presenting sufficient data and analysis to determine whether an environmental impact statement (EIS) or a finding of no significant impact (FNSI) is required.
- When the assessment indicates that a significant environmental impact may be engendered by the proposed construction and that

significant adverse impacts cannot be eliminated by making changes in the project, EPA publishes a notice of intent to prepare an EIS in the Federal Register.

- EPA and any other interested agencies determine the scope of issues to be addressed in the EIS and identify significant issues. (This process is called "scoping.")
- EPA prepares and distributes a draft EIS which describes various alternatives to the proposed action to all interested parties for comment and a public hearing is held.
- After external coordination and evaluation of comments received, EPA prepares and disseminates a final EIS which lists any mitigation measures required to make the recommended alternative environmentally acceptable.
- EPA approves or denies the permit.
- When the environmental assessment indicates no significant impacts are anticipated or when the project is altered to eliminate any significant adverse impacts, EPA issues an FNSI and the NEPA procedure is concluded.

In addition, there are other legal provisions to be considered. These include the requirements of the National Historic Preservation Act of 1966, the Archaeological and Historical Preservation Act of 1974, Coastal Zone Management Act of 1972, Wild and Scenic Rivers Act, Endangered Species Act, and others, along with implementing regulations.

Thermal Standards

Because of inherent inefficiencies in the generation of thermal power from steam, it is necessary to dispose of large amounts of waste heat. The process efficiency is a function of the steam temperature. Fossil-fueled steam generation plants operating at high steam pressures and temperatures can achieve about 40 percent efficiency. Present nuclear plants cannot operate at such high temperatures so their efficiency is commonly in the lower 30 percent range. In geothermal plants, with still lower steam temperatures and consequently lower efficiencies, the required disposal of waste heat will be even greater. A similar problem may also occur in other uses of geothermal resources such as space heating, depending, of course, on the particular process involved.

Effluent limitations guidelines and new source performance standards do not include limitations on the temperature of discharge wastewaters. Any necessary thermal limitations are established on a case-by-case basis, based on state water quality standards, through the NPDES permit program.

The thermal water quality standards for various states are given in Section V. In general, the limitation of temperature rise above normal is a function of the type of fishery desired in the water body. When the standards require that the waters should be suitable for at least a warm water fishery, maximum temperature rises 2.8°C (5.0°F) above ambient are prescribed. In some cases, maximum absolute discharge temperatures are also set for the water body. Where it has been judged that the water would be suitable for cold water fish, such as trout and salmon, the allowable temperature rise and absolute temperature are often more restrictive. In some of the northern states surveyed, where all waters are cooler, the more stringent limitations are applied statewide. In others, the degree of temperature rise limitation depends on the normal temperature of a given water.

Section 316(a) of the Clean Water Act provides for a variance from thermal standards when it can be shown that the introduction of a given amount of heat into the receiving body of water will not interfere with the "protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water." EPA and the various states which have received permit authority have set up detailed procedures dealing with obtaining such alternate limits. The regulations do not distinguish between existing and proposed new units.

The 316(a) procedures require a study to determine the present indigenous populations, a determination of how the temperature in the water body will be altered by the proposed discharge, and finally a determination based on the literature or new studies of how the new temperature would affect the indigenous population. In general, such a demonstration may require thermal modeling and ecological studies which include several seasons followed by a definitive report, and various public hearing and review procedures. Depending on the physical plant setup, the water body involved, and the state and Federal regulatory agencies, a considerable amount of time often elapses before a determination can be made under Section 316(a).

In a great many areas where geothermal resources may be used to produce electric power, there will not be a sufficiently large body of water available to accommodate the thermal discharges associated with the use of once-through cooling water for the condenser, and dissipation of heat by cooling towers will be necessary.

Another factor which must be considered when discussing the use of local water for once-through cooling is the intake structure. Section 316(b) of P.L. 92-500 requires that such facilities use the best available technology to minimize the effects of impingement and entrainment of the fish and other elements of the aqueous food chain. In general, NPDES permits for such structures require that information be submitted proving that such effects are minimal.

In summary, there may be limitations on the thermal component of any discharge of waters from geothermal resource utilization. Because of the lower temperatures of operation, and, hence, lower efficiencies of geothermal installations, such installations will normally reject a larger fraction of their total heat to waste than similar installations using fossil fuel or nuclear power. The need to dissipate this waste heat to the atmosphere or elsewhere, rather than to a local body of water, may increase the cost of geothermal development, but alternate methods of heat dissipation are readily available in the form of wet or dry cooling towers or cooling ponds.

Pretreatment Standards

It is not known whether there will be instances where disposal of geothermal effluents to publicly owned treatment works (POTW) will be cost-effective or otherwise feasible. Thus, this discussion may be only of marginal interest.

If this means of disposal were to be utilized, compliance with EPA's general pretreatment regulations implementing Section 307(b) of the Act would be required (40 CFR Parts 125 and 403, Federal Register, 28 January 1981). The general purposes of these regulations are to prevent:

- interference with the operation of the treatment works
- pass-through of pollutants
- municipal sludge contamination.

In addition to pollutants that would pass through a POTW untreated, prohibited discharges include:

- pollutants which create a fire or explosion hazard in the POTW
- pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with a pH lower than 5.0 unless the POTW is specifically designed to accommodate such discharge
- solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW constituting interference
- any pollutant, including BOD, released in a discharge at a flow rate and/or pollutant concentration which will cause interference
- heat in amounts which will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantitites that the temperature of the POTW exceeds 40°C (104°F) unless, at the request of the POTW, alternate limits are approved.

The pretreatment programs to implement those prohibitions are to be developed by POTW's themselves that have a design flow greater than five million gallons per day unless States with approved NPDES programs exercise their option to assume local responsibilities. All other POTW's, where interference or pass-through occurs or is likely to occur, are to set specific effluent limits for industrial users which are necessary to ensure compliance with the POTW's NPDES permit.

Ocean Disposal

Ocean disposal could be an attractive means of disposing of brines or other wastes generated by some contemplated future uses of geothermal resources. The geographic location of geothermal fields, particularly geopressured fields, near the ocean, or possibly under it, suggests that the ability to use this as an environmentally acceptable disposal method for some wastes could impact very favorably on achieving an operating permit.

Ocean disposal requires an NPDES permit, for a continuous discharge, under Section 403 of the Clean Water Act. The regulations (40 CFR Part 125, Federal Register, 12 February 1980) are designed to give permit writers flexibility in tailoring permit application requirements, effluent limitations, and reporting requirements to the specific circumstances of each discharger's situation.

Pollutant discharges which would cause unreasonable degradation of the marine environment are prohibited. Other discharges may be permitted if it is determined that degradation will not occur. In cases where such a determination cannot be made, the discharge will be prohibited unless EPA can determine that:

- The discharge will not cause irreparable harm to the marine environment pending further investigation.
- No reasonable alternatives to the discharge exist.
- The discharge will comply with mandatory permit conditions, including a bioassay-based discharge limitation and monitoring requirements.

The factors to be considered in determining whether a discharge will cause unreasonable degradation include:

- location of the discharge
- composition of the biological community and existence of special aquatic sites
- character and quantities of pollutants to be discharged
- economic and social impacts of a discharge.

Ocean dumping from vessels, if it were to be encountered in geothermal operations, would be regulated under provisions of the Marine Protection Research and Sanctuaries Act (PL 92-532).

UNDERGROUND INJECTION CONTROL

The Safe Drinking Water Act (P.L. 93-523 as amended by P.L. 95-190) mandated the establishment of minimum requirements for effective state underground injection control (UIC) programs designed to protect present or potential underground drinking water supplies from contamination through subsurface injection of fluids. EPA finalized the technical regulations for this purpose as 40 CFR Part 146 (Federal Register, 24 June 1980). The procedural aspects are covered in the consolidated permit regulations in 40 CFR Parts 122, 123, and 124. These technical and program requirements were amended as a result of a litigation settlement on August 27, 1981, 46 FR 43156, and on February 3, 1982, 47 FR 4992.

Upon approval of state program applications that meet the minimum requirements, the states are given primary enforcement authority. The regulations are designed to allow states flexibility in tailoring local programs to meet specific needs and to consider geologic, hydrologic, and historic conditions in establishing rules and permit conditions. The minimum requirements of the regulations must be met, however.

The Act defines "endangerment" as the presence of a contaminant which "may result in (a public water) system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons." To prevent this occurrence, a permit establishing construction and operating conditions must be obtained for most injection wells. In the case of geothermal injection wells, however, all wells are now Class V and can be operated under a general rule established by the state. Geothermal injection wells associated with power production were initially classified as Class III, requiring a permit, but they have been re-classified as Class V (47 FR 4999, February 3, 1982). Even these wells authorized by a general rule may not inject so as to allow any movement of fluids into an underground source of drinking water (USDW) that may cause a violation of any primary drinking water regulation or may otherwise adversely affect the health of persons.

A USDW is defined as an aquifer or portion:

- which supplies drinking water for human consumption
- in which the groundwater contains fewer than 10,000 mg/l of total dissolved solids.

However, aquifers may be exempt from classification as a USDW if:

- an aquifer does not currently serve as a source of drinking water
- it cannot now and will not in the future serve as a source of drinking water because:
    - -- it is mineral, hydrocarbon, or geothermal energy producing
    - -- it is situated at a depth or location which makes recovery of water for drinking purposes economically or technologically impractical

-- it is so contaminated that it would be economically or technologically impractical to render the water fit for human consumption

-- it is located over a geothermal well area subject to subsidence.

The significance of exempted aquifers is that EPA gave the states discretion to ease the regulatory requirements on wells that do not inject into, through, or above underground drinking water sources. Since full application of the requirements -- both in terms of information to be supplied by the permit applicant and the construction/operation/monitoring standards -- would be onerous and costly, the relief provided by an exempted aquifer would be extremely important.

Injection wells (Class V) supporting all geothermal energy uses will be subjected to a three-year EPA assessment of their construction features; the nature, volume, and contamination of the injected fluids; and their environmental consequences. Based upon the results of that assessment, EPA may decide on specific requirements for geothermal wells, or allow the wells to be authorized by rule indefinitely.

SOLID WASTE DISPOSAL

The Federal government was granted the authority to regulate the "management" of hazardous wastes and disposal of non-hazardous municipal wastes by the Resource Conservation and Recovery Act of 1976 (RCRA) (P.L. 94-580). For now, at least, the production of geothermal energy will be little affected by it.

RCRA defines "solid waste" as including solid, liquid, semisolid, or contained gaseous materials. Regulations implementing Subtitle C of the Act (40 CFR Part 261) provide that a solid waste is a hazardous waste if it is listed as a hazardous waste in Subpart D of Part 261 or the waste exhibits any of the characteristics defined in Subpart C. These characteristics include:

- ignitability (flash point below 60°C (140°F))
- corrosivity
- reactivity
- toxicity

While it is possible that the drilling muds used in geothermal development and production may contain some compounds which would meet the toxicity test, these muds, and those used in oil and gas drilling, were exempt, along with production wastes, by a recent amendment to RCRA (P.L. 96-482) from the definition of hazardous waste. This exemption is for two years pending the outcome of a study of these wastes by EPA.

The chemistry of the various individual components of drilling muds has been considered to be proprietary by the manufacturers of this product, and the user most frequently does not know what he is using and discarding.

Since RCRA places the responsibility on the generator of a waste to determine whether it is hazardous, at the present state of knowledge, case-by-case determinations would have to be made through chemical analyses. In its discussion of the generator regulations, EPA noted this is a special burden that will be placed on those facilities whose wastes are not constant in nature. However, "the continuing responsibility (of a generator) to know whether his wastes are hazardous" was noted, and it was pointed out that "those persons whose wastes are sometimes hazardous and sometimes non-hazardous have the same obligation as any other generator to ensure that all their hazardous wastes are ... (legally) ... managed." Pending the outcome of EPA's study, geothermal drilling operators are spared this burden under RCRA.

The wastes listed in Subpart D are mostly industry- or process-specific, and it appears clear that the use of geothermal energy in the listed industries or processes would not preclude the applicability of the hazardous definition to the wastes generated. The same legal question surrounding the applicability of effluent limitations guidelines and new source performance does not seem to pertain. This being the case, the operation would be considered a generator of hazardous waste.

Generators are regulated along with those who transport, treat, store, or dispose of hazardous wastes, although a permit is not required of generators. However, if a generator wishes to store his waste for more than 90 days, to treat it, or dispose of it on-site, he must obtain a permit, and he may not allow anyone to handle his wastes off-site unless they are permitted to do so. The standards applicable to operators of treatment, storage, and disposal facilities are highly detailed, covering all aspects of design, construction, and operation. There are no land disposal standards.

In addition to the permit system, another regulatory tool is applied. This is a manifest system with which all of the above parties must comply. The manifest, prepared by the generator, describes and quantifies the waste leaving the generator's premises and designates a disposal, treatment, or storage facility permitted to receive the type waste described to which the waste is to be delivered. One alternate site may be designated. Copies of the manifest are turned over to the transporter, and a copy must be signed and returned to the generator when the waste is delivered to its destination point. If the generator does not receive a copy from the designated receiving facility or alternate within 35 days, he must track the fate of the waste through the transporter and designated facility or facilities. If the manifest copy is not received in 45 days, the generator must file an Exception Report with EPA or the cognizant state agency.

As is the case with the other Federally-enacted environmental programs, RCRA envisioned that the states will eventually assume responsibility for the national hazardous waste management program. These programs are currently in formulation, but since they must be consistent with the Federal regulations, their requirements will be essentially as described above.

The state programs for managing the land disposal of non-hazardous wastes, under Subtitle D of RCRA, are similarly in preparation and must prohibit the establishment of new open dumps, and must provide for the upgrading or closure of existing open dumps. Geothermal wastes may be subject to these requirements.

CONTROL OF NOISE

The Noise Control Act of 1972 (P.L. 92-574) as amended by the Quiet Communities Act of 1978 (P.L. 95-609) vests the primary control of noise with state and local governments, but retains Federal regulatory authority over the production of four categories of low noise level products. These are: construction equipment, transportation equipment, any motor or engine (including any equipment of which an engine or motor is an intergral part), and electrical or electronic equipment.

With the exception of aircraft, state and local jurisdictions may adopt and enforce time-of-sale and in-use noise regulations for new products which are not yet subject to Federal regulation. Once a class of new products is regulated by EPA, however, state and local noise emission regulations for the same product must be identical to the EPA requirements.

Noise standards may also be promulgated by other Federal agencies in consultation with EPA. The Geological Survey has, in fact, included noise standards in GRO Order No. 4, identified and discussed in Section IV, which apply to noise levels of geothermal operations of Federal leases. These limit noise levels to 65 dB(A) at a distance of 660 feet. Table III-1 shows that if The Geysers operations producing the sound levels indicated were located on a Federal lease, virtually all of them might exceed the standards at 660 feet. The lower portion of the table provides the noise levels of more familiar activities for comparison.

Specific noise requirements of several states are presented in Section V and county standards in Section VI. Regardless of the entity promulgating the standard, enforcement is exceedingly difficult because of the lack of trained personnel to interpret subjective-type standards, and, in some cases, the lack of equipment needed to ascertain a violation.

EROSION/SEDIMENTATION CONTROL

The Clean Water Act does not specifically give EPA authority to promulgate regulations on non-point sources such as runoff from construction. The only reference to such sources in the "Standards and Enforcement" title of the Act required the Administrator to publish guidelines related to the quantity and nature of such runoff and methods to control it. The other reference in the Act is that areawide waste treatment management plans (Section 208) must include a process to identify construction-related sources of pollution and procedures (including land use requirements) to control associated erosion.

Hawaii is the only one of the 15 states surveyed in this study which has enacted a statute and implemented it with regulations which require the use of technologies to control erosion and sedimentation (Act 249 of Session Laws of Hawaii 1974 and Chapter 37-B of the Public Health Regulations). Other states have approached sediment or silt as a pollutant in a general

TABLE III-1. COMPARISON OF NOISE LEVELS BETWEEN THE GEYSERS GEOTHERMAL AREA AND OTHER NOISE SOURCE (3)

Source	SPL in dBa @ 50 ft.	@ 2,000 ft.
The Geysers area		
Construction	80-95	40-55
Mud drilling	80-90	40-50
Air drilling (muffled)	85-95	45-55
Testing (muffled)	85-95	45-55
Well cleanout	125	85
Standby well venting	65-85	25-45
	Level	Distance
Comparative levels		
Jet aircraft takeoff	125 dB(A)	200 feet
Threshold of pain	120 dB(A)	
Unmuffled diesel truck	100 dB(A)	50 feet
Street corner in a large city	75 dB(A)	
Residential area at night	40 dB(A)	

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dB(A) decibel value measured using the A weighting network of a standardized sound level meter.

way, but none mandate the use of control technologies. The Nevada Water Pollution Control Law empowered the State Environmental Commission to prescribe controls for diffuse, or nonpoint sources, and to delegate control to cities and counties. No documents were found to indicate that this authority has been utilized. In Idaho, nonpoint sources, such as construction sites, are not subject to the conditions and legal actions applicable to point sources if they are "conducted in a manner that demonstrates a knowledgeable and reasonable effort to minimize resulting water quality impacts." Legislation such as Hawaii's is rather recent, but there is sufficient interest both within EPA and the Soil Conservation Service of the Department of Agriculture to promote additional statutes in the near future.

The difficulty in this area is establishing any meaningful numerical or otherwise measurable standards which can be enforced. It is not anticipated, however, that requirements of the types adopted up to now in other jurisdictions to control erosion would have any particular inhibiting influence on geothermal development.

CONTROL OF SUBSIDENCE

The few attempts to regulate subsidence are divided between surveillance measures and "after-the-fact" requirements. The surveillance measures include the survey, benchmark, and monitoring requirements of the Federal geothermal regulations and GRO Order No. 4, a county Subsidence Detection Program in California which requires the installation of benchmarks, and a more detailed county subsidence and earth movement study, also in California. The regulatory requirements after subsidence has occurred or is about to occur are total or partial termination of operations. Wyoming has spelled out this procedure in more detail than others, and this section of its geothermal resources lease form is shown in Appendix F. The California Oil and Gas Division may regulate injection as related to the control of subsidence and may impose other subsidence control measures.

CONTROL OF RADIATION

This discussion is included here because radon, a naturally-occurring radioactive gaseous chemical element, has been found to occur in some geothermal fluids and in the steam used at The Geysers. Its decay products have been linked with increased cases of lung cancer according to an interagency study prepared for the Federal Radiation Policy Council (4). While ground levels of radon at The Geysers have not been found to exceed California standards, it is not known whether this element will be troublesome in other areas.

Section 201(f) of the Clean Water Act prohibits the surface discharge of any radiological warfare agent or high-level radioactive waste. These include the following classes of materials which are subject to the jurisdiction of the Federal Nuclear Regulatory Commission:

Byproduct material: Radioactive material yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

Source material: Uranium, thorium, or any other material which the NRC declares to be source materials.

Special nuclear materials: Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material declared by NRC to be special nuclear material.

These materials are not found in geothermal fluids and are of no concern to developers, and none of EPA's current efforts to develop programs for disposing of specific low-level radioactive substances appear to be relevant to radon in geothermal fluids or steam in terms of water or land disposal. However, the Agency has listed radionuclides as a hazardous pollutant under Section 112 of the Clean Air Act. Standards set under this section are health-based standards and cost and availability of control technology are not considered. These standards will be implemented and enforced by NRC in accordance with a Memorandum of Understanding signed by the two agencies in 1980.

It is understood that EPA will focus on sources of radiation not now controlled which include radon emissions from uranium mines. This indicates that naturally-occurring sources will be considered, but nothing has been published so far which would indicate attention on radon in geothermal resources.

While there is still considerable uncertainty on the matter, it appears that states would also generally tend to regulate any troublesome radon problems associated with geothermal development through their air, water, and land disposal regulations rather than through their licensing procedures for sources of radiation. In some states, the criterion for licensing would be that the release of radon is "man-enhanced."

In Arizona, the rules of the Radiation Regulatory Agency itself incorporate limits on concentrations of radon in the air in unrestricted areas above natural background. A general limit of 3×10^{-9} of Rn_{222} is established although higher limits may be approved if:

- the applicant demonstrates that he has made a reasonable effort to minimize the emissions
- information is provided as to flow rates, total volume of emissions, peak concentration, concentration averaged over a period of one year at the point where the emission leaves a stack, tube, pipe, or similar conduit
- the properties of the emission are described including chemical composition, physical characteristics including the nature of gas or aerosal, and size range of particulates
- the anticipated human occupancy in the unrestricted area where the highest concentration of radioactive material from the emission is expected is estimated

- information is provided on the highest atmospheric concentration in an unrestricted area, including anticipated concentrations averaged over a period of one year at any point of human occupancy
- emissions are monitored
- technology is utilized to reduce emissions.

There is also a limitation on permissible concentrations of nearly all of the elements in the Arizona radiation regulations in the waters of unrestricted areas. There are none, however, for radon in water, and it is assumed that this is because radon is one of a small group of elements whose concentrations in water have a direct correlation with their presence in air. They are all emitted as gases, and if they are controlled in air, they are automatically controlled in water.

SECTION IV

ENVIRONMENTAL ASPECTS OF THE FEDERAL GEOTHERMAL LEASING AND PERMITTING PROGRAM

Federal leasing and regulatory authority in geothermal exploration, development, and operation rests primarily in the Geothermal Steam Act of 1970. The Department of the Interior was given overall responsibility to allow mineral exploration and development while assuring rehabilitation of disturbed lands; protection of public health and safety; and full compliance with the spirit and objectives of the National Environmental Policy Act of 1969, other Federal environmental legislation, and supporting executive orders and regulations.

Delegation of the authority conferred on the Secretary of the Interior by the Act is two-pronged. As discussed in Section II, the Bureau of Land Management is responsible for the leasing of the geothermal lands and the Minerals Management Service (MMS) is charged with regulating operations on the leased lands. The U.S. Geological Survey (USES) assesses the nature of the resource and classifies lands as known geothermal resource areas.

BLM is the primary contractor with MMS as a third party who has the conditional power to modify the lease. MMS also has the power to suspend operations and recommend termination of the lease. In other words, MMS controls the technical aspects of geothermal leasing; BLM controls the administrative aspects of the lease. The Minerals Management Service implementation of the Geothermal Steam Act is spelled out in 30 CFR Parts 270 and 271; BLM's regulations are contained in 43 CFR Parts 3000 and 32000. Many provisions are identical or nearly so and are addressed only once in this discussion.

ENVIRONMENTAL IMPACT EVALUATION

The regulations require evaluation of the environmental impact of geothermal operations on an area -- the Federal lands and adjacent non-Federal lands -- when a parcel of land is initially considered for leasing or "when the need arises." This function is performed by BLM and the document produced is called an environmental assessment (EA). If BLM determines that development of a lease would constitute "a major Federal action significantly affecting the quality of the human environment," the Bureau is required by the National Environmental Policy Act to prepare, before leases are issued, a formal environmental impact statement (EIS) subject to public review. Subsequent to issuance of a lease, the MMS prepares an environmental analysis of the impact of the plan of operation itself -- i.e., a specific action. The necessity for an EIS may also be indicated at this point.

A programmatic environmental impact statement was prepared by the Department of the Interior in 1973 which assessed the social, economic, and environmental effects of the whole geothermal leasing program. It was hoped that because of the availability of this voluminous document (5) and the wealth of applicable information it contains, that full-blown environmental impact statements on specific land parcels would be held to a minimum. BLM has found only one necessary so far although the Forest Service has used the EIS almost exclusively.

The pre- and post-lease environmental assessments might be considered "mini" EIS's, but their cost in terms of manpower is considerably less than that for a full EIS. In addition, the time required for an EIS can range up to two or more years based on experience gained from the preparation of such statements prepared by BLM in connection with other leasing programs and Forest Service experience with geothermal EIS's. The latter agency is given the authority by 40 CFR Part 32000.0-6(b) to elect to conduct the environmental impact evaluation on lands under its jurisdiction.

ENVIRONMENTAL PROVISIONS OF LEASES

In accord with a Memorandum of Understanding, an internal document, among the BLM, MMS, and the Fish and Wildlife Service, the Bureau of Land Management, in cooperation with the Minerals Management Service, formulates the general requirements of geothermal leases and issues special stipulations, as necessary, which often are concerned with environmental protection. The Fish and Wildlife Service participates in developing such stipulations where fish and wildlife resources and related habitat are involved and in determining the mitigating measures to be taken to preserve these resources.

The BLM is responsible for monitoring for compliance with environmental protection requirements outside the operating area and the MMS examines operations to insure compliance. This function is carried out by the MMS Deputy Minerals Manager whose duties are established by the regulations. He is a representative of the Secretary subject to the direction and supervisory authority of the MMS. He also issues orders to operators for remedial action.

The broad requirement for compliance with all applicable Federal, state, and local environmental standards in the geothermal regulations is discussed in Section II. However, in addition to any action required by the standards, the lessee is ordered by the BLM regulations to take the following specific actions:

1. Pesticides and herbicides. The lessee shall comply with all rules issued by the Department of the Interior and the Environmental Protection Agency pertaining to the use of poisonous substances on public lands.

2. Water pollution. The lessee shall conduct lease operations and maintenance in accordance with Federal, state, and local water quality standards and public health and safety standards. Toxic materials shall not be released into any surface waters or underground waters. Injection of

waste geothermal fluids into geothermal or other suitable aquifers is to be managed in accord with the lessee's plan of operation.

3. Air pollution. The lessee shall control emissions from operations in accordance with Federal and state air quality standards and applicable local air quality standards.

4. Erosion control. The lessee shall minimize disturbance to vegetation, drainage channels, and stream banks. The lessee shall employ such soil and resource conservation and protective measures on the leased lands as the Supervisor deems necessary.

5. Noise control. The lessee shall control noise from operations in accordance with Federal, state, and local noise emission standards.

6. Sanitation and waste disposal. The lessee shall remove or dispose of all waste material generated in connection with the exploration, development, production, and transportation operations in a manner set forth in the approved plan of operation.

7. Land subsidence, seismic activity. The lessee shall take precautions necessary to minimize land subsidence or seismic activity which could result from production of geothermal resources and the disposal of waste fluid where such activity could damage or curtail the use of the geothermal resources or other resources, or other uses of the land, and take such measures as stipulated to: (1) monitor operations for land subsidence and for seismic activity; and (2) maintain and, when requested, make available to the lessor, records of all monitoring activities.

8. Aesthetics. The lessee shall take aesthetics into account in the planning, design, and construction of facilities on the leased premises.

9. Fish and Wildlife. The lessee shall employ such measures as are deemed necessary to protect fish and wildlife and their habitat.

10. Antiquities and historical sites. The lessee shall conduct activities on discovered, known or suspected archaeological, paleontological, or historical sites in accordance with lease terms or specific instructions.

11. Restoration. The lessee shall provide for the restoration of all disturbed lands in an approved manner.

The MMS regulations do not reference local environmental control requirements as the BLM document does. Because of this distinction, a lessee may be confronted with a situation in which the stipulations to his lease reference and incorporate applicable local standards which are preempted by omission in the MMS operating regulations. In addition, although the Deputy Minerals Manager is authorized to issue more stringent standards than the existing ones, it is not inconceivable that the lease may contain more restrictive stipulations than the Deputy Manager's order. GRO Orders, defined and described below, offer a vehicle for minimizing potential problems generated by the minor differences between the BLM leases and MMS operating requirements. In addition MMS has the authority to insert site-specific special post-lease conditions into the lease.

The plan of operation, which must be approved by both MMS and BLM, requires, among other things, a detailed presentation of the layout of operations and narrative descriptions of proposed measures to be taken to implement the above list of environmental actions. In addition, the position of mud tanks, reserve pits, cooling towers, pipe racks, etc., are prescribed. These separately relate to water and air pollution control and noise abatement. Monitoring may be required for one year prior to production to develop baseline data on existing air and water quality, noise, seismic and land subsidence activities, and ecological systems of the leased land (30 CFR, Section 270.34 (k)).

A sample BLM geothermal resources lease is shown in Appendix D. It will be seen that the lease does not specifically incorporate the compliance language of the regulations, although Section 14 could hardly be more specific in requiring protection of the environment in that all mitigating actions required by BLM shall be taken to prevent all of the types of environmental degradation enumerated above. The stringency of this section of the lease is subject only to the discretion of BLM in stipulating the required mitigating actions. The BLM notice of intent to conduct geothermal exploration operations (shown in Appendix E) does not contain, in Condition 1, the compliance language of the regulations.

Both the BLM and MMS regulations require lessees to submit annual reports on measures taken to comply with environmental requirements. MMS is closely supervising The Geysers and Imperial Valley operations, but this type of scrutiny may not be maintainable as geothermal leases increase both in acreage and numbers of lessees involved.

Lessees are also required to report within 24 hours occurrences of significant environmental damage or noncompliance with standards. The definition of "significant" is unclear, but failure to report could result in suspension or termination of the lease. On the other hand, the Deputy Manager is authorized, whether the report is made or not, to shut down any operations he determines are causing or can cause pollution, a feature of concern to geothermal operators. Except in extreme cases, the regulations are interpreted to give the operator a chance to remedy the problems.

BLM is highly concerned with the protection of historic or scientific values. The lease requires notification of all historic or prehistoric ruins, fossils, or artifacts discovered and specifies that they shall be left intact. Prior to commencing operations, the lessee must furnish a certified statement that archaeological values do not exist or that they may exist where land is to be disturbed. In the latter case, he must engage a qualified archaeologist to survey and salvage such values before operations may begin. Failure to comply may constitute a violation of the Antiquities Act (16 USC 431-433).

GEOTHERMAL RESOURCES OPERATIONS ORDERS

Geothermal resources operations orders are formal orders issued by MMS (formerly by USGS) to supplement the general regulations found in 30 CFR 270 by detailing the procedures operations must follow in a given area or region. The purpose of this arrangement is to allow consideration of more area-specific operating and environmental conditions.

The MMS has issued seven GRO's. They are:

- GRO Order No. 1 - Exploratory Operations
- GRO Order No. 2 - Drilling, Completion, and Spacing of Geothermal Wells
- GRO Order No. 3 - Plugging and Abandonment of Wells
- GRO Order No. 4 - General Environmental Protection Requirements
- GRO Order No. 5 - Reports and Forms
- GRO Order No. 6 - Pipelines and Surface Production Facilities
- GRO Order No. 7 - Production and Royalty Measurement, Equipment and Testing Procedures

While appropriate environmental protection and reclamation measures are generally required by the GRO's, it is, as indicated above, GRO Order No. 4, promulgated on 15 August 1975, which mandates environmental protection for all stages of exploration and development on Federal geothermal resources leases located in the MMS central and western regions.

Relevant Federal and State environmental standards are usually made applicable along with existing technology, but local and/or regional standards apply only in certain instances. Exceptions to compliance with any of the standards can be granted by the Deputy Manager on a case-by-case basis. Conversely, he may establish more stringent standards by field-order, usually in the form of special stipulations.

The lessee's overall general responsibility to protect the environment is to:

- Provide maximum protection to the environment during exploration and development operations;
- Rehabilitate impacted areas;
- Protect by all necessary means the public health and safety;
- Conduct operations in compliance with all applicable Federal laws and executive orders.

Monitoring of "readily identifiable localized environmental impacts" caused by the activities specifically under the lessee's control shall be conducted by the lessee. Frequency of such monitoring activity will be decided by the Deputy Manager who will consider each site's conditions in establishing the monitoring rates. As described above, a year of baseline data on air, water quality, noise, seismic and land subsidence activities, and ecological systems may be required before production goes on stream.

The following impacts and accompanying requirements are set out in the Order as being "protectable:"

- Aesthetics. Visual impact, where feasible, shall be minimized by careful site selection. The facilities should be constructed so as to blend with their natural surroundings.

- Land Use and Reclamation. Essentially, MMS requires that geothermal operations disturb land, water, and vegetation as little as possible. Operations and reclamation procedures are subject to approval by the Deputy Manager and the surface management agency involved (BLM, Forest Service). Since multiple use of the leased land is allowed, geothermal operations are not to interfere unreasonably with other authorized uses. Entry to fragile areas must be controlled by limited access routes or by use of special vehicles.

- Public Access. Such access is to be unrestrained except when circumstances mandate controlled access to:

  - protect public health and safety;

  - prevent undue interference with operations or security;

  - protect the public, wildlife, and livestock from hazardous geothermal activity.

- Recreation. Areas designed for recreation near geothermal areas are to be "adequately protected" from degradation. Development sites are to be located at least 61 m (200 ft.) from established recreation sites and accompanying access routes. The Deputy Manager, however, may allow the lessee to relocate the recreation site if the surface management agency agrees to the change.

- Slope Stability and Erosion Control. Mitigating measures for soil and natural resource protection are required to prevent sedimentation from occurring in waterways.

- Biota. Mitigation measures required to protect endangered or threatened flora and fauna may exceed those required by the lease. Under the Endangered Species Act, reclamation and restocking of destroyed flora and fauna by the lessee is required if the area will not naturally recover.

- Cultural Resources Protection. The lessee may not disturb "any known cemetery or burial ground of any group or culture." Preservation of historic sites shall be in accordance with Executive Order 11593 ("Protection and Enhancement of the Cultural Environment") and conducted with the lessee's "due diligence." Caution must be exercised by BLM/MMS and the applicant so as to protect historically-important areas. Even if historic properties are not listed in the Historic Register, local public interest might necessitate mitigating measures by a lessee in order to offset adverse public opinion.

- Subsidence and Seismicity. Land subsidence shall be prevented by surveys and by adequate record-keeping of operations. If the Supervisor finds that subsidence is potentially significant or that it has occurred, then he may reduce or terminate operations or require seismograph monitoring equipment. Surveys shall be conducted in accordance with county/state requirements, and bench marks shall be established before "prolonged" production begins.

- Pollution and Waste Disposal. All Federal and State standards with respect to air, land, water, and noise pollution must be complied with by the lessee. Additionally, erosion control and any waste disposal shall be conducted in compliance with such laws. This section is divided into various categories, with emphasis placed on control of water pollution. Requirements set out for various forms of pollution are:

  -- Natural water shall not be contaminated by the lessee. The rest of the environment shall be only minimally affected.

  -- If disposal of harmful liquids (including toxic and heated substances) cannot meet the standards, the liquids are to be injected back into a geothermal well or any other formation approved by the Deputy Manager.

  -- The Deputy Manager's approval is necessary for disposal of solid wastes at approved sites.

  -- Federal, State, or regional air pollution standards are the criteria for air emissions and the lessee must obtain any necessary permits for air emissions from the appropriate air pollution control agency. This permit plus required reports must be submitted to the Deputy Manager.

  -- No water pollution is permitted to occur by reason of pits and sumps. The lessee has to reasonably restore the aesthetic and natural resource values of the area when the use of pits and sumps ceases.

  -- The lessee is required to train operating personnel in pollution prevention methods.

- In addition to the above requirements, noise levels may not exceed 65 dB(A) unless all residents located within .8 km (0.5 mi) of the operation agree to an increased level or an emergency arises. The ambient noise level used for ranking the permissibility of additional noise is "the minimum sound level at the relevant place and time in the absence of the source noise and shall include consideration for the type of land use, and the season, atmospheric conditions, and the time of day." Noise parameters can be established by the Deputy Manager, after assessment, in accordance with Federal or State criteria with adjustments for specific site conditions.

Noise levels are to be measured at .8 km (0.5 mi) from the source or at the lease boundary line, whichever is greater. Noise meters shall be those that meet U.S. Standard Specifications. Measurements shall be made at least three meters (9.84 ft) from a structure and one meter (3.28 ft) above ground level. Site variables, such as weather conditions, are to be taken into consideration. Monitoring frequency shall be determined by the Deputy Minerals Manager.

SECTION V

STATE STATUTES/REGULATIONS APPLICABLE TO GEOTHERMAL DEVELOPMENT

INTRODUCTION

This section consists of summaries of state legislation and regulations which may bear upon geothermal development. These documents include those which relate directly to geothermal development and others which represent the state's overall efforts to control air and water pollution and noise emissions, to regulate the disposal of solid wastes, and to require assessment of the environmental impact of activities within the state.

There are perhaps several alternative formats which could be used for presenting the summaries. It was decided, however, that the ability to compare the approach of the states in a given area of control is enhanced by grouping the summaries for all states according to subject matter -- i.e., air pollution, water quality, etc. -- rather than placing the summaries of all of a state's documents under one state listing.

It will be noted that while some of the provisions of the geothermal regulations are reasonably specific in terms of drilling and abandonment practices, for example, they do not generally set "standards," as such. A study of the summaries of air and water pollution control regulations also discloses that very few of the potential pollution parameters of geothermal wastes are covered by existing numerical standards in these documents.

The latter point is illustrated, for example, by the fact that the predominance of states have promulgated emission standards for only the first six air contaminants for which EPA set national ambient air quality standards (NAAQS): sulfur dioxide, particulates, hydrocarbons (excluding methane), carbon monoxide, ozone, and nitrogen oxides. None of the gases on this list are found in the various published lists of gases typically associated with geothermal resources, although there are literature references to the presence of sulfur dioxide, both in this country and New Zealand (6, 7). It is also understood that through reaction which occurs in the power plant operations, small amounts of SO_2 may be generated from hydrogen sulfide at The Geysers. Even if both of these occurrences were found to be universally true, SO_2 emissions are not likely to reach the concentration levels which would justify the importance in geothermal development which the summaries set out below attach to this pollutant. The emphasis given to it is there only because of the emphasis in the regulations and not because of a judgment of its relative significance.

The balance of the above standards are primarily related to motor vehicle exhaust, and it is doubtful that they will exert any effect on geothermal activities but they are included in this report to make the record complete. It is not as certain whether the same observation can be made regarding lead, which is the subject of the seventh NAAQS. The literature indicates the presence of lead in trace quantities at a number of geothermal sites where the resource has been analyzed, and in larger quantities at a site in Imperial Valley, California (8). Lead has generally been measured in water and solid wastes, not in air samples, at geothermal sites.

The regulation summaries also raise the issue of whether some types of current standards designed for other purposes can be applied to geothermal processes. The control of particulates illustrates this potential problem. The most popular particulate emission standard in the geothermal states is a case in point. In this standard, allowable particulate emissions are calculated on the basis of process weight per hour. Process weight can conceivably be interpreted to mean the water or steam input into a geothermally operated electric generating plant, for example, although enforcement probably would be difficult. Some of the standards exclude liquid or gaseous fuels from the weight calculation; Wyoming has carried this one step further and expressly excludes all water and steam. This language was obviously not designed with geothermal operations in mind.

Odor will also be a troublesome parameter for the control agency and geothermal operators alike where it is a characteristic of a given resource. Many odor regulations do not define it and only embrace some very nonspecific language about its control. Others simply prohibit odor without offering alternatives -- a virtually impossible type of regulation to enforce -- and others have undertaken to be so specific that they will be equally difficult of compliance. Montana, for example, provides that any operation which discharges odorous materials -- vapors, gases, dusts, or combinations thereof -- must install odor control devices or procedures specified by the state control agency. It is futher required that such odorous materials be confined at the point of origin and treated before discharge. If odorous matter escapes and creates a public nuisance, the agency may order that a building or buildings where the odors originate be tightly closed and ventilated in such a way that all air, gases, and gasborne materials leaving the building are treated by incineration or other effective means.

In all of the discussions of numerical standards, if there is a difference between those for new and existing sources, the new source standard is usually discussed. This approach is taken because existing sources in the geothermal field are few in number and are already experienced in the limitations applicable to their operations.

GEOTHERMAL RESOURCE STATUTES/REGULATIONS

The statutes enacted and regulations promulgated for the express purpose of guiding the development of geothermal resources of 15 states are listed by title in Table V-1. These states are Alaska, Arizona, California, Colorado, Hawaii, Idaho, Louisiana, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming. Their agencies which adopt and administer the regulations are identified in Table V-2.

TABLE V-1. STATE STATUTES AND REGULATIONS
Geothermal

State	Statute	Regulation
Alaska	Chapter 175, Laws of Alaska, 1980, An Act relating to state resources and the development of geothermal resources	(The statute is very recent, and regulations have not yet been developed.)
Arizona	Sections 27-651 through 27-666, Arizona Revised Statutes, Geothermal Resources (drilling)	Arizona Administrative Rules and Regulations, Sections R12-7-201 through R12-7-294
California	Geothermal Resources Act, Public Resources Code, Sections 6901-6925.2; and Sections 3703.1-3772.8	Leases and Prospecting Permits for Geothermal Resources, California Administrative Code, Title 2, Division 3; Title 14, CAC, Subchapter 4
Colorado	Geothermal Resources Act, C.R.S. 1973, 34-70-101-110 (drilling) C.R.S. 1973-1-112 (leasing)	Rules and Regulations for the Development and Production of Geothermal Resources, Rule 303
Hawaii	Section 182-1, Hawaii Revised Statutes, Relating to Reservation and Disposition of Government Mineral Rights	Regulations on Leasing of Geothermal Resources and Drilling for Geothermal Resources in Hawaii
Idaho	Section 42-4001-4015, Idaho Code	Drilling for Geothermal Resources, Rules and Regulations and Minimum Well Construction Standards
Louisiana	Act No. 735 of 1975 Geothermal and Geopressured Energy Research and Development Act	Order No. 29-P, Statewide Order Governing the Drilling for and Producing of Geothermal Resources
	Act 134 of 1976 Geothermal Energy Resources	
Montana	An Act to Empower the Board of Land Commissioners to Lease Geothermal Resources on State Lands, Chapter 26, R.C.M. Leases of Geothermal Resources	Geothermal Rules and Regulations, Title 77, Chapter 4, Part 1, MAC
	Montana Utility Siting Act of 1973, Title 70, Chapter 8, R.C.M. 1947, as amended	

Continued

TABLE V-1. Continued

Name	Statute	Regulation
Nevada	An Act Relating to Geothermal Resources, Chapter 534A.010, NRS	Rules and Regulations for Drilling Wells
New Mexico	Geothermal Resources Conservation Act, Chapter 272, Laws of 1975	Rules and Regulations concerning the Sale, Lease, and Other Dispositions of State Trust Lands
	Sections 75-11-11, 75-2-12, and 75-12-4, New Mexico Statutes Annotated, 1973 Compilation	Rules and Regulations, Oil Conservation Division (drilling)
Oregon	Geothermal Resources Act of 1975, Oregon Revised Statutes, Chapter 273 (leasing), ORS Chapter 522, ORS Chapter 537	Oregon Geothermal Regulations, OAC, Chapter 6, Division 20
Texas	Geothermal Resources Act of 1975, Tex. Rev. Civ. Stat. Ann. Act 5421S	Railroad Commission Rules and Regulations Pertaining to Geological and Geophysical Exploration and Surveys; TAC Title 31, Part IV School Land Board
Utah	Sections 73-1-20 through 73-1-27, Utah Code Annotated 1953, Geothermal Resource Conservation Act	Rules and Regulations Governing the Issuance of Mineral Leases
		Rules and Regulations of the Division of Water Rights for Wells Used for the Discovery and Production of Geothermal Energy in the State of Utah
Washington	Geothermal Resources Act, Chapter 79.76, RCW 90.44, RCW 90.14, RCW 18.104	Chapter 332-17 WAC
Wyoming	No statute	Rules and Regulations Governing the Issuance of Geothermal Resources Permits and Leases

TABLE V-2. STATE AGENCIES WHICH PROMULGATE AND ADMINISTER REGULATIONS AFFECTING GEOTHERMAL PRODUCTION AND USE

State	Promulgating Agency	Administering Agency
ALASKA		
Geothermal	Commissioner of Natural Resources (leasing and drilling)	Department of Natural Resources
Water	Department of Environmental Conservation	Same
Air	Department of Environmental Conservation	Department of Environmental Conservation
Noise	No regulations	
Soild Waste	Department of Environmental Conservation	Same
Radiation	Department of Health and Social Services	Same
ARIZONA		
Geothermal	State Land Department (leasing)	Same
	Oil and Gas Conservation Commission (drilling)	Same
Water	Water Quality Control Council	Department of Health
Air	County Boards of Supervisors	Department of Health
Noise	No regulations	
Solid Waste	Department of Health Services	Same
Radiation	Radiation Regulatory Agency	Same
CALIFORNIA		
Geothermal	Lands Commission* (leasine) Division of Oil and Gas, Department of Conservation* (drilling)	Same
Water	State Water Quality Control Board* and Regional Water Quality Control Boards	Same
Air	Air Resources Board* and Air Pollution Control Districts	Same
Noise	Department of Health, Office of Noise Control	No regulations
Solid Waste	Solid Waste Management Board*	County enforcement agencies or the Solid Waste Management Board*
Radiation	Resources Agency	Same

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*All of these agencies are within the Resources Agency of California.

Continued

TABLE V-2. Continued

State	Promulgating Agency	Administering Agency
COLORADO		
Geothermal	Department of Natural Resources, State Board of Land Commissioners (leasing) Oil and Gas Conservation Commission (drilling)	Same
Water	Water Quality Control Commission, Department of Health	Division of Administration, Department of Health
Air	Air Quality Control Commission, Department of Health	Same
Noise	No regulations	
Solid Waste	Department of Health	Same
Radiation	Department of Health	Same
HAWAII		
Geothermal	Board of Land and Natural Resources	Department of Land and Natural Resources
Water	Director of Health	Department of Land and Natural Resources
Air	Director of Health	Department of Land and Natural Resources
Noise	Director of Health	Department of Land and Natural Resources
Solid Waste	Director of Health	Department of Land and Natural Resources
Radiation	Director of Health	Department of Land and Natural Resources
IDAHO		
Geothermal	Board of Land Commissioners (leasing); Department of Water Resources (drilling)	Same
Water	Board of Health and Welfare	Department of Health and Welfare
Air	Board of Health and Welfare	Department of Health and Welfare
Noise	No regulations	
Solid Waste	Board of Health and Welfare	Department of Health and Welfare
Radiation	Board of Health and Welfare	Department of Health and Welfare
LOUISIANA		
Geothermal	Mineral Board (leasing); Oil and Gas Commission (drilling)	Same
Water	Environmental Control Commissioner	Office of Environmental Affairs
Air	Environmental Control Commissioner	Office of Environmental Affairs
Noise	No regulations	
Solid Waste	Environmental Control Commission	Office of Environmental Affairs
Radiation	Environmental Control Commission	Office of Environmental Affairs

Continued

TABLE V-2. Continued

State	Promulgating Agency	Administering Agency
MONTANA		
Geothermal	Board of Natural Resources and Conservation	Same
Water	Board of Health and Environmental Sciences	Department of Health and Environmental Sciences
Air	Board of Health and Environmental Sciences	Department of Health and Environmental Sciences
Noise	No regulations	
Solid Waste	Board of Health and Environmental Sciences	Department of Health and Environmental Sciences
Radiation	Board of Health	Same
NEVADA		
Geothermal	Division of State Lands, Department of Conservation and Natural Resources (leasing) State Engineer (drilling)	Same
Water	Environmental Commission	Department of Conservation and Natural Resources
Air	Environmental Commission	Department of Conservation and Natural Resources
Noise	Environmental Commission	Department of Conservation and Natural Resources
Solid Waste	Environmental Commission	Department of Conservation and Natural Resources
Radiation	Environmental Commission	Department of Conservation and Natural Resources
NEW MEXICO		
Geothermal	Office of the Commissioner of Public Lands (leasing) State Engineer (drilling)	Same
Water	Water Quality Control Commission	Same
Air	Environmental Improvement Board	Environmental Improvement Agency
Noise	No regulations	
Solid Waste	Environmental Improvement Board	Environmental Improvement Agency
Radiation	Board of Health	Consumer Health Protection Service

Continued

TABLE V-2. Continued

State	Promulgating Agency	Administering Agency
OREGON		
Geothermal	Division of State Lands (leasing); Department of Geology and Mineral Industries (drilling)	Same
Water	Environmental Quality Commission	Department of Environmental Quality
Air	Environmental Quality Commission	Department of Environmental Quality
Noise	Environmental Quality Commission	Department of Environmental Quality
Solid Waste	Environmental Quality Commission	Department of Environmental Quality
Radiation	Environmental Quality Commission	Department of Environmental Quality
TEXAS		
Geothermal	General Land Office and School Land Board (leasing); Railroad Commission (drilling)	Same
Water	Water Development Board	Department of Water Resources
Air	Air Control Board	Same
Noise	No regulations	
Solid Waste	Department of Health Resources (municipal); Department of Water Resoruces (industrial)	Same
Radiation	Department of Health Resources	Same
UTAH		
Geothermal	State Land Board (leasing); Division of Water Rights (drilling)	Same
Water	Committee on Water Pollution	Same
Air	Air Conservation Committee	Division of Environmental Health
Noise	No regulations	
Solid Waste	Board of Health	Division of Environmental Health
Radiation	Bureau of Radiation and Occupational Health	Same
WASHINGTON		
Geothermal	Department of Natural Resources	Same
Water	Department of Ecology	Same
Air	Department of Ecology	Same
Noise	Department of Ecology	Same
Solid Waste	Department of Ecology	Same
Radiation	Department of Ecology	Same

Continued

TABLE V-2. Continued

State	Promulgating Agency	Administering Agency
WYOMING		
Geothermal	State Board of Land Commissioners (leasing)	Same
	Gas and Oil Commission, State Engineer (drilling)	
Water	Environmental Quality Council	Department of Environmental Quality
Air	Environmental Quality Council	Department of Environmental Quality
Noise	No regulations	
Solid Waste	Environmental Quality Council	Department of Environmental Quality
Radiation	No regulations	

Portions of some of the statutes and regulations which are germane to environmental control are summarized below. Other documents were omitted because either they are so general in nature they would add little to this discussion or they do not involve environmental considerations.

In addition, repetition of very general provisions common to the documents summarized has been omitted for the sake of brevity. Mandatory compliance by an operator with all applicable Federal, state, and county laws and right-of-entry authority for the environmental regulatory agency typify this type of provision.

In general, the requirements for restoration of a completed or abandoned well site have also been omitted. These most frequently require that the area be returned to its original condition to the extent practicable. While this may involve effort and expenditures which an operator would not undertake if left to his own devices, it is sufficiently common to applicable regulations that this practice is or probably will soon become a universally required procedure. Past experience with strip mining has apparently led legislators and regulatory agencies to attempt to avoid this type of environmental damage at the outset.

Similarly, requirements for structures and landscaping harmonious with the area are not repeated throughout the summaries. This, too, is generally applied.

It is emphasized that the summaries do not represent the content of the whole document and that provisions which duplicate the requirements of others are not always repeated.

Alaska

Chapter 175, Laws of Alaska 1980, an Act relating to State resources and the development of geothermal resources --

This new statute gives the responsiblity for leasing of land for geothermal prospecting and development and supervision of the activities carried out on the leased land to the Commissioner of Natural Resources. The Act directs the Commissioner to adopt regulations relating to the siting, spacing, drilling, casing, cementing, testing, logging, operating, producing, and abandonment of geothermal wells so as to prevent:

- geothermal resources, water or other fluids, and gases from escaping into strata other than that in which they are found (unless in accordance with an approved injection program)
- contamination of surface and ground water
- premature degradation of a geothermal system by water encroachment or otherwise
- blowouts, cavings, and seepage

- unreasonable disturbance or injury to neighboring properties, prior water rights, human life, health, and the natural environment

Since the statute is so recent, regulations for these purposes have not yet been issued.

Arizona

Sections 27-651 through 27-666, Arizona Revised Statutes - Geothermal Resources --

This chapter authorizes the Oil and Gas Conservation Commission to oversee geothermal activity. The environmental requirements include: a directive to the Commission to prevent the discharge of any fluids or gases or disposition of substances harmful to the environment by reason of drilling, operation, maintenance, or abandonment of geothermal wells; watertight casing for bore holes penetrating an aquifer to a geothermal resource below; construction and maintenance of all geothermal water and brine disposal systems so as to avoid contamination of underground or surface waters; water quantity and quality monitoring devices; reinjection of geothermal effluent or injection of other water supplies into the producing zones at the discretion of the Commission.

Rules and Regulations of the Arizona Oil and Gas Conservation Commission, Sections R12-7-201 through R12-7-294 --

These regulations deal primarily with drilling of wells and operation practices which are not of direct concern to this discussion. However, the engineering and documentation requirements during drilling and testing can be summarized as follows:

An application for a drilling permit must be accompanied by a plat showing the exact acreage or legal subdivision allotted to a well. The major purpose of the plat is to permit the Commission to determine whether the well is a permitted location under the well-spacing program requested in the application. The commission is authorized to approve well-spacing programs or prescribe modifications after giving consideration to factors such as the following: (1) topographic characteristics of the area; (2) hydrologic, geologic, and reservoir characteristics of the field; (3) the number of wells that can be economically drilled to provide the necessary volume of geothermal resources for the intended use; (4) protection of correlative rights; (5) minimizing well interference; (6) unreasonable interference with multiple use of lands; and (7) protection of the environment. In order to assure a supply of drilling mud to confine oil, gas, water, or other fluid to its native stratum during the drilling of a well, operators must provide an adequate pit, either earthen or portable, for this fluid or the accumulation of drill cuttings.

Casing requirements are spelled out in great detail, both for areas where pressure and formations are unknown and where the subsurface conditions have been established. No well may be directionally deviated from its normal course without permission from the Commission, except that wells may be intentionally deviated for short distances to straighten the hole, sidetrack junk, or correct other mechanical difficulties. Directional survey of wells may be required.

A well operator must minimize noise when conducting air drilling operations or when the well is allowed to produce while drilling. The noise created by the expanding gases must be abated by methods approved by the Commission.

There are two sets of environmental practices set forth under well operating practices. The first is headed "Pollution and Surface Damage" and reads as follows:

> "The owner or operator shall take all reasonable precautions to avoid polluting streams, polluting underground water, and damaging soil. If any deleterious substances cannot be treated or destroyed, or if the volume of such products is too great for disposal by the usual methods without damage, other means of disposal, after approval by the Commission, shall be used."

The second is entitled "Environmental Protection" and reads as follows

> "In the absence of coverage by any other Section of these regulations, the Commission shall require operations under this Chapter to be conducted so as not to pollute the underground water or the land upon which the operations are being conducted, or pollute underground waters of neighboring lands. Federal and State air and water quality standards will be followed unless more stringent requirements are stipulated by the Commission. Plans for disposal of well effluents must take into account the effect on ground waters, streams, plants, fish and wildlife and their populations, atmosphere, or any other effects which may cause or contribute to pollution, and such plans must be approved by the Commission before action is taken under them."

Brines and salt water liquids must be disposed of by evaporation in earthen pits or by underground injection as authorized by the Commission. Earthen pits must be constructed to prevent escape of brines and entry of surface water into the pit.

Injection of substances to increase recovery of geothermal resources is prohibited unless authorized by the Commission. Strict requirements on the construction of such injection wells are set forth.

California

Geothermal Resources Act, Public Resources Code, Sections 6901-6925.2 -- Prospecting permits and leases are issued under this Act by the State Lands Commission. The Act was amended in 1978 to recognize that some parcels of land display strong indications of geothermal resources and likelihood of commercially producible energy which could be leased competitively, and other parcels indicate potential but need additional exploration, and still other parcels have never been explored. As a result, prospecting permits issued on the last two categories of land require the drilling of a geothermal well during the term of the permit. Unless a well is initiated, the term cannot be extended and annual rentals rise significantly until a well is commenced.

Another new feature of the amended act is the provision for leases of less than 640 acres issued to the first qualified applicant if the geothermal resource is to be used for a purpose other than power generation. This provision should make it much easier for individuals, co-ops, small commercial and industrial users, and other small direct users to gain access to the resource.

Geothermal Resources, Public Resources Code, Sections 3703.1-3772.8 -- Under Sections 3714 and 3741, when a developer files notice of intent to drill, either on state or private land, he becomes subject to this statute which places well safety and conservation of the resource under the Division of Oil and Gas in the Department of Conservation. The State Oil and Gas Supervisor is directed to permit well operators to utilize all methods and practices known to the industry which will increase the ultimate recovery of the resource suitable on a case-by-case basis. State policy is enunciated which interprets the right or power granted to operators to explore for and remove geothermal resources to do "what a prudent operator using reasonable diligence would do...in producing and removing resources..."

Approval of the notice of intent to drill by the Supervisor is required before drilling may begin. This applies to original drilling, redrilling of an abandoned well, deepening a well, plugging, or altering or removing the casing of a well.

The regulatory power of the Oil and Gas Division includes authority to require indemnity bonds; require logs on well characteristics and drilling activities; approve casing strength; require tests or remedial work; and approve and supervise abandonment procedures. The Division may also impose injection requirements and is empowered to control subsidence. The log records may not be used in court or other enforcement proceedings except in limited instances for review of enforcement decisions by the Supervisor or the Geothermal Resources Board. The Board consists of: The Director of Conservation, State Geologist, Oil and Gas Supervisor, Executive Officer of the State Lands Commission, Chairman of the Water Resources Control Board, Director of Water Resources, Director of the Department of Fish and Game, and President of the Public Utilities Commission.

If an operator does not perform required remedial work ordered to protect environmental or other values, state agents may enter the premises and do the work, the cost of which then constitutes a lien on the property. Wells drilled within 30.5 m (100 ft) of an outer property boundary or a public street or highway are declared nuisances. This distance is reduced to 8.0 m (25 ft) to accommodate directional drilling when insufficient surface area of a land parcel of one acre or more is available for locating a well, and to a 4.5 m (15 ft) for the drilling of low temperature wells under the direction of the Supervisor.

Direct uses are addressed again in this Act which defines a "low temperature geothermal well" as one from which fluids can be produced which have value by virtue of the heat contained therein and have a temperature that is no more than the boiling point of water at the altitude of occurrence." The indemnity bonds for shallow low temperature wells are considerably less than for deep wells which do not meet this definition, and the Oil and Gas Division may approve, within geothermal resource areas, wells of this description with greater administrative freedom than is required for other wells.

Under 1978 amendments to this Act, permitting requirements pursuant to California's Environmental Quality Act (CEQA), discussed below, are divided among three agencies according to stage of development -- i.e., the Division of Oil and Gas is the lead agency in the environmental review process at the exploration stage; the counties assume this role for field development; and the State Energy Commission acts during power plant permitting. Counties are also given the authority by the 1978 amendments to take the lead agency status at the other two stages if they write a geothermal element into their general plan and develop approved permitting and hearing procedures. Thus far, only Imperial County in Southern California has taken advantage of this authority. The four counties in the vicinity of The Geysers have opted for continuation of the state agency role.

Title 2, California Administrative Code, Division 3 - State Property Operations, Article 4.1 - Leases and Prospecting Permits for Geothermal Resources --

This regulation is administered by the State Lands Commission. Lands subject to leasing are those within geothermal resources areas, and prospecting permits are issued on those not lying within such areas. In filing applications to the Commission for geothermal prospecting permits the quality and use of underlying groundwaters and adjacent surface waters must be described, and the proposed methods of disposing of liquid, solid, or gaseous wastes must be stated. These must protect and preserve existing land and water uses.

The engineering and documentation requirements during drilling and testing are set forth in the Section (2257) entitled "Development Program." These are shown in full here because they are typical of requirements which appear in one or another of the various geothermal regulations. They apply to geothermal operations on state land under the jurisdiction of the State Lands Commission.

"DEVELOPMENT PROGRAM.

"(a) Operations under any lease or permit shall be carried on in a safe and workmanlike manner in accordance with generally accepted good engineering practice and due regard shall be given the protection of life and property, preservation of the environment and the conservation of natural resources.

"(b) The State Lands Division may determine the spacing of wells and the rate of development and production of such wells to prevent the waste of geothermal resources and to promote their maximum economic recovery from, and the conservation of reservoir energy in, each zone or separate underground source of geothermal resources. Such determination shall be based on recognized engineering standards and shall be consistent with prevailing economic conditions.

"(c) Geothermal resources shall not be disposed of except in accordance with sales contracts or other methods which have first been approved of in writing by the State Lands Commission.

"(d) All geothermal resources wells shall be tested when required by the State Lands Division.

"(e) No lessee or permittee shall drill a geothermal resources well on or into state lands except on prior approval of the State Lands Division and subject to the terms of the enabling statute and lease or permit.

"(f) Lessee or permittee, before commencing the work of drilling a well, shall notify the State Lands Division of its intention to drill, and such notice shall contain the location and elevation above sea level of derrick, proposed depth, bottom hole location, casing program, proposed completion program and the size and shape of drilling site, excavation and grading planned, and location of existing and proposed access roads. Where the surface of the leased or permitted lands is under the jurisdiction of a state agency other than the Commission, lessee or permittee shall provide at the same time such information listed above as is pertinent to that agency.

"(g) No well shall be perforated, redrilled, plugged back, or altered except on prior approval of the State Lands Division.

"(h) All drilling, redrilling, perforating, or work-over operations within any geothermal resources zone shall be done with an accepted circulating medium.

"(i) No generating plants, buildings, structures, production equipment, metering system, pipelines or roads for the production of geothermal resources shall be installed except on prior state approval. Any changes in said equipment or facilities shall be approved prior thereto. Maps, drawings and specifications for said installations shall be furnished upon request.

"(j) Metering equipment shall be maintained and operated in such a manner as to meet acceptable standards of accuracy. Use of such equipment shall be discontinued at any time upon determination by the State Lands Division that standards of accuracy or quality are not being maintained, with production stopped until measurement accuracy has been obtained.

"(k) Lessee or permittee shall diligently maintain all wells and continuously vent and periodically blow wells to prevent water condensation and cooling of the well bore.

"(l) Before work is commenced to abandon any well, notice shall be given to the State Lands Division, which notice shall show the condition of the well and the proposed method of abandonment. No well may be abandoned unless prior approval of the method of abandonment has been obtained from the State Lands Division."

Section 2263 prescribing measures for the protection of other resources is also presented in full because its separate provisions appear to illustrate the types of directives to which geothermal operators will be required to conform:

"PROTECTION OF OTHER RESOURCES.

"(a) The lessee or permittee shall remove the derrick and other equipment and facilities within sixty (60) days after lessee or permittee has ceased making use thereof in its operations.

"(b) All permanent operating sites where required shall be landscaped or fenced so as to screen them from public view as far as possible. Such landscaping or fencing shall be approved in advance by the state and kept in good condition.

"(c) All drilling and production operations shall be conducted in such manner as to eliminate as far as practicable dust, noise, vibration, or noxious odors. Operating sites shall be kept neat, clean, and safe. Drilling dust shall be controlled to prevent widespread deposition of dust. Detrimental material deposited on trees and vegetation shall be removed. The determination as to what is detrimental is a state responsibility.

"(d) Wastes shall be discharged in accordance with requirements and prohibitions prescribed by the Regional Water Quality Control Board. The State Lands Division and the state agency having jurisdiction over the affected lands shall also approve the place and manner of such waste disposal.

"(e) Lessee or permittee shall communicate with the Department of Fish and Game prior to any operations which may adversely affect fish and wildlife resources.

"(f) Any operations disturbing the soil surface, including road building, construction, and movement of heavy equipment in support of or relating to specific geothermal exploration or development activities shall be conducted in such manner as will not result in unreasonable damage to trees and plant cover, soil erosion, or in degradation of waters of the State, including fish and aquatic life habitat.

"(g) Pollution of the ocean and tidelands, rivers, lakes or other bodies of water, and all impairment of and interference with bathing, fishing, or navigation in the waters of the ocean, or any bay or inlet thereof, is prohibited, and no brine, minerals, or any refuse of any kind from any well or works shall be permitted to be deposited on or pass into waters of the ocean, any bay or inlet thereof, rivers, lakes or other bodies of water, without specific written state authorization.

"(h) No permanent filled lands, piers, platforms or other fixed or floating structures in, on, or over the tide and submerged lands covered by the lease or permit or otherwise available to the lessee or permittee shall be permitted to be constructed, used, maintained, or operated without obtaining any and all permits required under applicable state and federal law, rules and regulations, or complying with all valid ordinances of cities and counties applicable to lessee's or permittee's operations, or without securing the written permission of the State Lands Division specifically authorizing the activity.

"(i) Existing roads and bridges on or serving the area under lease or permit shall be maintained in a condition equal to or better than that before use. New roads and bridges shall be located, constructed, and maintained in accordance with state specifications.

"(j) Timber damaged, destroyed, or used on the area under lease or permit shall be compensated at market value to the state. Borrow pit material shall not be obtained from state lands without permission and payment of market value.

"(k) Improvements, structures, telephone lines, trails, ditches, pipelines, water developments, fences and other property of the state or other lessees or permittees, and permanent improvements and crops of surface owners, shall be protected from damage and repaired or replaced when damaged.

"(l) Access to drilling or production sites by the public shall be controlled by the lessee or permittee to prevent accidents or injury to persons or property.

"(m) Drilling mud shall be ponded in a safe manner and place, and where required by the state, posted with danger signs, and fenced to protect persons, domestic animals, and wildlife. Upon completion of drilling, the mud shall be disposed of, or after drying in place, covered with a protective layer of soil.

"(n) Areas cleared and graded for drilling and production facility sites shall be kept to a reasonable number and size, and be subject to state approval.

"(o) Lessee or permittee shall conduct its operations in a manner which will not interfere with the right of the public to fish upon and from the public lands of the state and in the waters thereof or will not preclude the right of the public to use of public lands and waters."

The suspension of drilling and production operations is required (1) in the event of disaster or of pollution caused by the operations or (2) when the State Lands Division determines that there is a substantial likelihood that continued operations would endanger public health or safety or cause serious damage to property or the natural environment.

Title 14, California Administrative Code, Subchapter 4, State-Wide Geothermal Regulations--

All of the foregoing requirements of the California State Lands Commission pertaining to geothermal operations on state lands notwithstanding, geothermal well drilling and/or abandonment is regulated state-wide by the Division of Oil and Gas. Its regulations, cited above, were extensively amended in response to the 1978 amendments to the geothermal statute.

They permit the Supervisor of the Division to designate geothermal fields for administrative purposes. A field must contain at least one well capable of producing geothermal resources in commercial quantities, and each such well becomes the center of a one-mile square. When sufficient geologic and engineering information is available, the Supervisor may adopt rules or amend existing rules applicable to individual fields or areas. He must notify affected persons and give them 30 days for response.

Before drilling can be initiated, a Notice of Intention to Drill must be filed with and approved by the Division of Oil and Gas. The filing form calls for considerable information on the proposed well and the area where it is to be located, including reference to or a copy of any environmental document prepared by a government agency for the proposed well.

If operations on an exploratory well or observation well for which the Division is required to prepare environmental documents have not commenced within two years from the date of approval of the Notice of Intention to Drill, the Division must cancel the notice unless an extension is requested. Notices for operations on a development, exploratory, or observation well for which the Division is not required to prepare environmental documents are cancelled after one year.

Notice are required for shallow observation wells, but they may cover up to 25 such wells and less information is called for than for deep wells. However, if the Supervisor determines that one or all of the proposed wells will require additional supervision, he may require that a standard Notice be filed.

If the construction of drilling sites, roads, sumps, steam transmission lines, or other construction could cause or could be affected by slumping, landslides, or unstable earth conditions, the operator will be required to submit a written analysis of the proposed work before his Notice will be approved. The Supervisor may require preparation of the analysis by a civil engineer experienced in soils engineering, or, where slumping or landsliding could be involved, by an engineering geologist.

Colorado

Special Rules and Regulations Relating to Geothermal Resources Leases--

These regulations were adopted and are administered by the State Board of Land Commissioners pursuant to CRS 1973-1-112. They provide for leasing state-owned property on a non-competitive basis or by public auction if there is competition for the same tract of land. The Board may issue permits only for exploratory wells, which are defined as those used to obtain geological and hydrological information. Other types of wells are permitted by the Oil and Gas Conservation Commission, as discussed below, but a log of each well drilled on the leased land must be furnished to the Land Board.

Rules and Regulations for the Development and Production of Geothermal Resources, Rule 303 --

These regulations were adopted by the Oil and Gas Conservation Commission pursuant to Colorado's Geothermal Resources Act, Title 34, Article 70, CRS 1973.

A permit is required from the Commission to drill a geothermal well in Colorado, regardless of depth and regardless of whether it is on state or private land, although the procedures for obtaining permits for observation wells are simpler than those for subsequent wells. The information required before deeper wells can be drilled includes the following:

- amount and extent of surface development anticipated
- measures taken to protect against land subsidence, contamination of surface and ground waters and the air, and excessive noise levels
- proposed methods of geothermal by-product disposal and geothermal by-product recovery
- mineral and chemical composition of any brine and associated gases of the geothermal resource.

This written statement can be based on data from an observation well or from "similarly situated geothermal resource areas." Acceptance of the latter type of information is somewhat unusual in the geothermal field. It seems to carry out the stated intent that the written statement "must not place an undue burden upon the exploratory drilling process."

Permits for wells in a designated ground water basin must be approved by the Groundwater (sic) Commission (CRS 1973, 37-90-104).

An additional permit is required from the Oil and Gas Conservation Commission to excavate a retaining pit to store substances produced from the well and drilling muds. This feature is more commonly covered by the permit to drill the well itself.

Hawaii

Regulations on Leasing of Geothermal Resources and Drilling for Geothermal Resources in Hawaii --

Applications for leases under these regulations must be accompanied by a brief preliminary proposed plan for geothermal exploration and development and an assessment of the environmental impact from geothermal exploration and development. Once the lease has been obtained, the operator of the lease must take all reasonable precautions to prevent waste and damage to any natural resources including vegetation, forests, and fish and wildlife, injury and damage to persons, real or personal property, and degradation of the environment. A narrative statement must be included in a Plan of Operations describing the proposed measures to be taken for protection of the environment, including, but not limited to the prevention or control of:

- fires
- soil erosion

- pollution of the surface and ground water
- damage to fish and wildlife and other natural resources
- air and noise pollution
- hazards to public health and safety.

An approved Plan of Operation is prerequisite to drilling and other activities on the lease. Even though a drilling permit has been obtained to drill a well, a new permit is required if the well is to be modified for injection purposes.

Idaho

Drilling for Geothermal Resources Rules and Regulations and Minimum Construction Standards--

Sections 42-4001-4015 of the Idaho Code conferred upon the Department of Water Resources the authority to regulate the drilling, operation, maintenance, and abandonment of all geothermal wells in the state. The Department's authority also includes regulatory jurisdiction over environmental hazards pertaining to the exploration and development of geothermal resources.

The rules give the Department very specific authority over drilling practices and well spacing. A permit is required to drill a well, modify an existing one, or convert a production well to an injection well.

The Water Resources Director is required to approve all well spacing programs or prescribe modifications he feels are necessary for proper development considering the same factors as those enumerated in the Arizona regulations.

The casing and blow-out prevention requirements of these rules are so specific that their total impact would be lost in summarizing them. They are thus reproduced in full in Figure V-1.

There are additional blow-out prevention requirements established both for explored and unexplored areas. A Department employee may be present during any drilling phase in the latter and may order additional casing to be run if he sees fit. A logging unit must be installed and operated continuously once the shoe has been drilled out of the conductor pipe until the well has been drilled to the total depth. Data to be recorded include:

1. Drilling mud temperatures (in and out).
2. Drilling mud pit level.
3. Drilling mud pump volume.

Figure V-1. Excerpt From Idaho Rules and Regulations, Minimum Well Construction Standards for Geothermal Resources

4.6 Casing

4.6.1 General. All wells shall be cased in such a manner as to protect or minimize damage to the environment, usable groundwaters, geothermal resources, life, health, and property. The permanent well head completion equipment shall be attached to the production casing or to the intermediate casing if production casing does not reach the surface. No permanent well head equipment may be attached to any conductor or surface casing alone. The specification for casing strength shall be determined by the Director on a well-to-well basis. All casing reaching the surface shall provide adequate anchorage for blow out prevention equipment, hole pressure control, and protection for natural resources. Sufficient casing shall be run to reach a depth below all known or reasonably estimated groundwater levels to prevent blow outs or uncontrolled flows. The following casing requirements are general but should be used as guidelines in submitting applications for permit to drill.

4.6.2 Conductor pipe. A minimum of 40 feet of conductor pipe shall be installed. The annular space is to be cemented solid to the surface. A 24-hour cure period for the grout must be allowed prior to drilling out the shoe unless additives sufficient, as determined by the Director, are used to obtain early strength. An annular blow out preventor shall be installed on all exploratory wells and on development wells when deemed necessary by the department.

4.6.3 Surface casing. The surface casing hole shall be logged with an induction electrical log or equivalent or gamma-neutron log before running casing. This requirement may be waived by the Director. Permission to waive this requirement must be granted by the Director in writing prior to running surface casing. This casing shall provide for control of formation fluids, protection of shallow usable groundwater, and for adequate anchorage for blow out prevention equipment. All surface casing shall be cemented solid to the surface. A 24-hour cure period shall be allowed prior to drilling out the shoe of the surface casing unless additives sufficient, as determined by the Director, are used to obtain early strength.

a) A minimum of 200 feet of surface casing shall be set in areas where pressures and formations are unknown. In no case may surface casing be set at a depth less than 10 percent of the proposed total depth of the well.

b) In areas of known high formation pressure, surface casing shall be set at the depth determined by the Director after a study of geologic conditions in the area.

Figure V-1.--Continued

c) In areas where subsurface geological conditions are variable or unknown, surface casing shall be in accordance with specifications as outlined in (a) above. The casing must be seated through a sufficient series of low permeability, competent lithologic units such as claystone, siltstone, basalt, etc., to insure a solid anchor for blow out prevention equipment and to protect usable groundwater from contamination. Additional casing may be required if the first string has not been cemented through a sufficient series of such beds, or a rapidly increasing thermal gradient or formation pressures are encountered.

d) The temperature of the return drilling mud shall be monitored continuously during the drilling of the surface casing hole. Either a continuous temperature-monitoring device shall be installed and maintained in a working condition or the temperature shall be read manually. In either case, the return temperature shall be entered into the log book for each 30 feet of depth drilled.

e) Blow out prevention equipment capable of shutting in the well during any operation shall be installed on the surface casing and maintained ready for use at all times. BOPE pressure tests shall be performed by the operator for department personnel on all exploratory wells prior to drilling out the shoe of the surface casing. The decision to perform BOPE pressure tests on other types of wells shall be made on a well-to-well basis by the Director. The Director must be notified five (5) days in advance of a scheduled pressure test. Permission to proceed with the test sooner may be given orally by the Director upon request by the operator.

4.6.4 Intermediate casing. Intermediate casing shall be required for protection against anomalous pressure zones, cave-ins, washouts, abnormal temperature zones, uncontrollable lost circulation zones or other drilling hazards. Intermediate casing strings when installed shall be cemented solidly to the surface or to the top of the casing.

4.6.5 Production casing. Production casing may be set above or through the producing or injection zone and cemented either below or just above the objective zones. Sufficient cement shall be used to exclude overlying formation fluids from the geothermal zone, to segregate zones, and to prevent movement of fluids behind the casing into possible fresh groundwater zones. Production casing shall either be cemented solid to the surface or lapped into the intermediate casing if run. If the production casing is lapped into an intermediate string, the casing overlap shall be at least 50 feet, the lap shall be cemented solid, and the lap shall be pressure tested to insure its integrity.

4.7 Electric Logging. All wells except observation wells shall be logged with an induction electrical log or equivalent or gamma-neutron log from the bottom of the hole to the bottom of the conductor pipe. This requirement may be modified or waived by the Director upon written request.

4. Drilling mud weight.

5. Drilling rate.

6. Hydrocarbon and hydrogen sulfide gas volume (with alarm).

An annular BOPE (blow-out prevention equipment) with a minimum working pressure of 68.04 atm (1,000 PSI) is required on the surface casing. If unusual conditions are anticipated, a BOPE may be required on the conductor pipe. If the exit drilling mud temperature reaches 125°C (257°F), drilling operations must cease until the Department of Water Resources has been notified.

In explored areas, a gate valve with a minimum working pressure rating of 20.41 atm (300 PSI), must be installed on the well head. Mud temperature must be monitored continuously or read manually and logged for each 9 m (30 ft) of depth drilled.

Equally specific abandonment requirements are set forth which cover type and placing of cement and use of drilling fluid in the procedure.

Louisiana

Act No. 735 of 1975 Louisiana Geothermal and Geopressured Energy Research and Development Act--

This Act gave the State Department of Conservation the responsibility for the management and coordination of a geothermal and geopressured energy research and development program. Among its responsibilities were the determination of the environmental ramifications and the legal, social, and economic consequences of geothermal development, and providing a framework of policy alternatives for the commercial utilization of this resource.

Act No. 134 of 1976 Geothermal Energy Resources--

This Act vests full regulatory authority over all geothermal exploration, drilling, development, and production, as well as subsurface disposal of geothermal waters and/or waste, in the Department of Conservation. The provisions of the Louisiana State Conservation Act (R.S. 30:1, et seq.) are extended to all geothermal operations, and the Commissioner of Conservation is empowered to promulgate such further rules and regulations as he deems necessary.

The Stream Control Commission is given supervisory authority over discharges to surface streams, and the State Mineral Board is vested with exclusive authority to lease state lands for geothermal purposes. However, the above-described regulation of conservation applies to all geothermal operations in the state, whether on public or private land. "In all cases," the Act states, "a lessee under a geothermal lease or an owner shall conduct his exploration, drilling, development, production operations, and disposal methods using all reasonable precautions to protect the environment and to prevent pollution of state waters, other environmental damages, or waste of geothermal resources."

Order No. 29-P -- Statewide Order Governing the Drilling for and Producing of Geothermal Resources in the State of Louisiana--

This order was adopted pursuant to Act No. 134 of 1976 by the Office of Conservation which is also the implementing agency. Drilling permits are required for geothermal wells or conversions of existing wells for geothermal development below the fresh water sands. Tables are provided for determining the amount of surface, intermediate, and producing casing (number of feet), number of sacks of cement to be used, and casing test pressure (psi) according to well depth. Office of Conservation personnel are given access to the mud records of any drilling well, "except those records which pertain to special muds and special work with respect to potential rights." This is a unique provision, so far as is known, and guards securing surrounding proprietary drilling muds discussed in Section III under "Solid Waste Disposal."

Montana

Montana Geothermal Rules and Regulations, Title 77, Chapter 4, Part 1, Montana Codes Annotated--

These regulations, adopted by the Board of Land Commissioners pursuant to MAC No. 26-2-11, apply only to geothermal leases on state lands and are administered by the Department of State Lands. Lessees are required to use all reasonable means to prevent waste, damage to any natural resource, and any environmental pollution or damage. These methods are to be described in a plan of operations submitted prior to drilling wells 305 m (1,000 ft) or deeper. Such measures must cover prevention or control of fires, soil erosion, pollution of surface and groundwater, damage to fish and wildlife, air and noise pollution, and hazards to public health and safety. When wells are abandoned, interzonal migration of fluid is to be blocked so as to prevent contamination of waters and protect life, health, environment, and property. Specific plugging requirements are spelled out.

Operators of wells in high pressure areas or in areas where the pressures are unknown are required to equip wells "with casings of sufficient strength seated in competent rock formation and cemented in place with such other safety devices as may be necessary...and use every reasonable effort to prevent blowout, explosions, and fires..."

Nevada

Rules and Regulations for Drilling Wells --

These regulations were adopted by the Division of Water Resources pursuant to Chapter 534A.010, Nevada Revised Statutes.

In addition to the permit required to drill a well and compliance with casing and other requirements, these regulations also require a permit to appropriate water. This is typical of all western states where strict water right laws prevail. A great deal of verification is needed, but once the application is approved, the right granted is a perpetual one to use a specified amount of water for a specific purpose within a defined area.

A permit to appropriate water is not needed for exploration holes, but state personnel indicated that it might be prudent to obtain one in designated ground water basins.

New Mexico

Rules and Regulations, Geothermal Resources--
These regulations, adopted pursuant to Chapter 75, Laws of 1973, are probably the most detailed of those reviewed in terms of drilling, production, casing, spacing, plugging, and report requirements, but among the least definitive in terms of environmental requirements.

Maxmimum protection of the environment is mandated; a drilling fluid pit of adequate size to provide sufficient fluid to confine natural fluids to their native strata and prevent blowouts is required to be constructed so as to prevent water pollution; noise abatement equipment as approved by the Oil Conservation Division is required during drilling or production of wells within 457.5 m (1,500 ft) of a residence, school, or church; and highly mineralized waters are to be disposed of in such a manner that underground or surface waters are not contaminated.

Rules and Regulations Governing Drilling of Wells and Appropriation and Use of Ground Water in New Mexico --
While statutory authority is granted to the Oil Conservation Division to regulate geothermal activities in the state, the State Engineer has absolute authority over the appropriation of water within declared underground water basins which cover much of the state. Thus, two permits are required to drill a well, a situation of concern to both administering agencies.

Oregon

Oregon Geothermal Regulations, Oregon Administrative Code, Chapter 6, Division 20 --
The regulatory responsibilities for geothermal operations in Oregon are divided between two agencies. The Department of Geology and Mineral Industries (DOGAMI) implements the above regulations which govern wells more than 2,000 feet deep and/or which are drilled to produce fluids of 250°F or greater. The Department of Water Resources regulates shallow, low-temperature wells in much the same manner as common water wells, although the Department of Geology and Mineral Industries may also issue blanket permits for geothermal gradient holes of less than 2,000 feet. As many as 100 holes may be drilled under the latter type of permit.

In order to obtain a DOGAMI permit to drill, details of the mud system are to be submitted including mud pit capacity and type of mud to be used. It is not clear whether the trade name of the mud product is sufficient, or whether an analysis of its constituents would be required.

Texas

Geothermal Resources Act of 1975 --

This Act vested regulatory powers in the state Railroad Commission and leasing powers in the General Land Office. The regulatory authority of the Railroad Commission extends to exploration, development, and production on all public and private lands. The General Land Office acts through the School Land Board to lease geothermal/geopressured resources on lands belonging to the Permanent School Fund of Texas (except wildlife refuges and recreational areas).

There appears to be some contradiction in terms in the Act in that the Railroad Commission, in consultation with the Land Commissioner and the head of the Water Quality Board and Air Control Board, is directed to promulgate and enforce rules for the orderly development of the geothermal resource. In another section, the School Land Board is given "full authority" to set the terms and conditions of leases and may adopt rules and regulations relating to exploration, development, and production of geothermal energy in the state. Protection of the environment was mandated as a part of the Commission's rules. All oils or chemicals must be removed from salt water slush or mud materials before they can be disposed of in water.

Texas Administrative Code, Title 31, Part IV, School Land Board --

Geothermal activities are covered in these regulations by the general term "other minerals." However, in a provision regarding pipeline leaks, it is required that when a leak occurs, a pipeline carrying oil, distillate, or geothermal energy will be stopped at once and in cases where it is necessary to break out the line for repairs, all liquids will be cleared from the line before the repair is done. Another provision is that all wells producing liquids must be produced through an oil and gas separator of ample capacity. No exemption is provided for geothermal.

General Land Office Rules and Regulations--

The General Land Office has not amended its rules to include geothermal/geopressured activity. However, rules and regulations pertaining to geological and geophysical exploration and surveys were issued by the agency in 1971 which do include geothermal development. These rules primarily set out the permitting procedure and the regulations for "shot" exploration.

Railroad Commission Rules and Regulations--

The Railroad Commission rules implement the Texas Geothermal Act, and they now equate the treatment of geothermal with oil and gas. They represent one of the most comprehensive specific engineering and documentation requirements reviewed.

Environmental protection is aimed primarily at protecting the quality of Texas waters. Rule 3.8 states that fresh water, above or below the surface, shall be protected from pollution "whether in drilling, plugging, producing or disposing of salt water already produced." No operations may pollute "any stream or water course...or any subsurface waters." Salt water disposal pits are not to be used for storage and evaporation of geothermal resource waters nor are such resource waters to be discharged into a dry or flowing creek or river without the commission's approval. The offshore and estuarine zones shall not be polluted or the aquatic life contained therein injured. The disposal of liquid wastes into these kinds of zones is limited to salt wastes and other materials which have had harmful or injurious constituents removed.

Rule 3.9 requires a permit for deep well injection of salt water. Nonproducing zones of oil, gas, or geothermal resources that contain mineralized water unfit for general use can be used for injection of salt water. These zones must not be attached to freshwater formations in order to avoid contamination of such formations.

Casing requirements for protection of fresh water sands that are or may be a source of fresh water are set in Rule 3.13. No environmental concerns are expressed.

Field rules that consider the conditions of a specific area of operation may be issued by the Commission after the first well has been completed.

Utah

Rules and Regulations Governing the Issuance of Mineral Leases--
Provision for geothermal leases is made in Rule 10 of the above rules and regulations. They are issued by the Divison of Lands, Department of Natural Resources, only on lands where the State of Utah owns both the surface and mineral rights. Well permits are issued by the Division of Water Rights under regulations containing essentially the same minimum well construction standards as those of Idaho shown in Figure V-1.

Environmental requirements are written into the lease itself rather than in the regulations. In the lease terms for development of the leasehold, the lessee is prohibited from discharging unconfined hot water, nonpotable water, or polluting substances upon the land surface or into the subsurface which will contaminate soil or water. This is a flat prohibition with no guidelines or alternatives offered.

In general provisions of the lease, the lessee is directed to comply with applicable Federal and state air and water pollucion regulations; to control noise as required by the State Land Board or as required by state law; and to dispose of waste to protect wildlife, and to operate on archaeological or historical sites in accordance with directions from the State Land Board. In addition, the Land Board reserves the right to add such protective measures as it deems necessary on a case-by-case basis.

Washington

Geothermal Resource Act--
The thrust of this Act is to provide for the safe, orderly, and nearly pollution-free development of the state's geothermal resources, although lessees are only granted the right to those resources capable of producing electricity. The definition of waste includes the escape of steam or hot

water into the open air in excess of what is reasonably necessary in efficient development or production.

The Act preempts local regulation of the drilling and operation of geothermal wells -- the only instance of this found -- although the state is precluded from permitting operations where they would be prohibited under state or local land use laws or regulations. Policy is established that all geothermal fluids must be injected into the same reservoir from which they are withdrawn unless secondary use of by-product water resources for beneficial use is authorized by the Department of Ecology.

Geothermal resources by-products and/or waste products escaping from an operation are subject to all state pollution control laws, state fisheries law, and the state game laws.

The Department of Natural Resources is given the authority to administer the Act including the prevention of damage to underground and surface waters, land, or air that may result from improper drilling, operation, maintenance, or abandonment of geothermal resource wells. The Board of Natural Resources is currently developing implementing regulations.

Geothermal Drilling Rules and Regulations--

Geothermal wells used for electic power production must conform to these regulations. They are also very similar to those of Idaho shown in Figure V-1. Wells used for direct applications will be regulated by the Department of Ecology, and regulations for that purpose are currently in preparation.

Wyoming

Due to inadequacies in Wyoming's laws governing geothermal development which allow many inconsistencies and potential conflicts for developers, new legislation is under consideration. According to the Wyoming Geothermal Commercialization Office, the proposed law will accomplish the following:

- retain the definition of geothermal as "underground water" in order to minimize changes in regulations and the Federal intrusion into control of Wyoming water

- change the principal regulatory agency to the Wyoming Gas and Oil Commission in order to tap its expertise in high temperature, high pressure, deep drilling; the State Engineer would still issue well drilling permits

- retain the Board of Land Commissioners as the leasing agency, providing "grandfathered" rights for current water permit holders and/or mineral lease holders

- define as "small" geothermal uses of less than 2,500 therms per year (a therm is 100,000 BTUs --- 2,500 therms is the energy needed to heat four Wyoming homes per year) and define as "large" geothermal uses of 2,500 therms or more

- assure bonding and taxation powers needed for municipal development of geothermal resources, and
- insure that the quality and quantity of Wyoming waters is not deleteriously affected by geothermal development.

The Wyoming geothermal lease form contains the most detailed provisions on subsidence found, and they are shown in full in Appendix F.

STATE NEPA-TYPE STATUTES AND REGULATIONS

Several states have enacted statutes which are analogous to the National Environmental Policy Act of 1969 as shown in Table V-3. Other states do not have a formal environmental impact review procedure, but cognizant state conservation or environmental agencies comment on proposed actions.

The California Environmental Quality Act of 1970 is probably as comprehensive as any existing state statute requiring the prior evaluation of the environmental impact of both public and private activities. Guidelines for implementing the Act have been promulgated which are even more comprehensive.

These two documents were blamed for several years for creating considerable delay in expansion of The Geysers operations in California. It is understood now, however, that California's new "one-stop shopping" permitting program has served to reduce their delaying effects considerably.

Because of the importance attached to the implementing guidelines and because they may be the forerunner of others to come, a very thorough summary is included here. The Act in its entirety is shown in Appendix G. A comparison of the guideline summary and the Act will provide a comprehensive view of the intent and effect of this legislation.

Summaries of the environmental impact evaluation requirements of other "geothermal" states follow the California discussion.

California

Title 14, Natural Resources, California Administrative Code, Division 6, Chapter 3, Guidelines for Implementation of the California Environmental Quality Act of 1970--

These guidelines were promulgated by the Resources Agency pursuant to the Environmental Quality Act of 1970 (Public Resources Code Section 21000). They are to be followed by all state agencies, boards, and commissions, counties, cities, regional agencies, and all other subdivisions of the state. The guidelines are called the "State Environmental Impact Report (EIR) Guidelines."

This document covers 52 printed pages. Its major functions are to establish the criteria by which it will be determined whether an EIR is required for a given project, which agency should take the lead role in pre-

TABLE V-3. STATE STATUTES AND REGULATIONS

Environmental Impact

	Statute	Some Form of Review	None
Alaska		X	
Arizona		X	
California	X		
Colorado		X	
Hawaii	X		
Idaho			X
Louisiana			X
Montana	X		
Nevada	X[1]		
New Mexico			X
Oregon		X	
Texas		X	
Utah	X[2]		
Washington	X		
Wyoming			X[3]

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[1] No guidelines have been issued; environmental evaluation of new sources is required by Air Quality Rules.

[2] Executive Order of the Governor.

[3] None affecting geothermal development.

paring the EIR, directions for the preparation of various environmental documents (including the EIR) required by the Act, and instructions for interagency review and public participation. The major policy thrust is that the state government shall regulate the activities of private individuals, corporations, and public agencies in a manner which will prevent environmental damage. The definition of "project" which applies to geothermal activity is "the whole of an action which has a potential for physical impact on the environment, directly or ultimately" which involves "the issuance of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies."

An environmental impact report is defined as an informational document completed for the purpose of informing decision-makers and the general public of the environmental effects of activities which may affect the environment. EIR's should omit unnecessary descriptions of projects and emphasize feasible mitigation measures and alternatives to projects.

CEQA does not apply to "ministerial projects such as business licenses nor to certain remedial actions taken in emergency or disaster situations, but is applicable to all "discretionary" projects except categorically exempt projects. A "discretionary" project is an activity which requires the exercise of judgment, deliberation, or decision on the part of the agency with the responsibility to approve or disapprove a particular activity. This is distinguished from the above ministerial project, approval of which requires only a determination of conformity with applicable statutes, ordinances, or regulations. Categorially exempted projects are those that have been determined not to have a significant effect on the environment -- e.g., replacement or reconstruction of existing structures where the new structure will be located on the same site as the structure replaced and will have substantially the same purposes and capacity.

Discretionary projects are first subject to an "initial study" or preliminary analysis to determine whether an EIR is required. If it is decided at this stage that the project would not have a significant effect on the environment, then a "negative declaration" is prepared presenting the reasons for this decision.

If any of the effects of a discretionary project may have a substantial adverse impact on the environment, then an EIR must be prepared regardless of whether the overall effect of the project is adverse or beneficial. Where there is a difference of opinion within an agency as to whether an effect is adverse or beneficial, an EIR is to be prepared to explore the point if there is, or there is anticipated to be, a substantial body of opinion which considers the effect adverse.

In evaluating the environmental significance of a project, both primary and secondary consequences must be considered. According to the definition of the guidelines, primary consequences are directly related to the project, and secondary effects are the consequences of the project -- i.e., a sewage treatment plant creates more growth (primary) and new growth impacts upon the resource base, including air, water, and energy use (secondary).

Projects are considered to have a potential for significant environmental effect when they include a change that:

1. Is in conflict with environmental plans and goals that have been adopted by the community where the project is to be located;

2. Has a substantial and demonstrable negative aesthetic effect;

3. Substantially affects a rare or endangered species of animal or plant, or habitat of such a species;

4. Causes substantial interference with the movement of any resident or migratory fish or wildlife species;

5. Breaches any published national, state, or local standards relating to solid waste or litter control;

6. Results in a substantial detrimental effect on air or water quality or on ambient noise levels for adjoining areas;

7. Involves the possibility of contaminating a public water supply system or adversely affecting groundwater;

8. Could cause substantial flooding, erosion, or siltation;

9. Could expose people or structures to major geologic hazards.

In every case where it is found that any of the following conditions will result from a project, the project shall be deemed to have impacts with a significant effect on the environment:

1. Impacts which have the potential to degrade the quality of the environment or curtail the range of the environment.

2. Impacts which achieve short-term gains to the disadvantage of long-term environmental goals.

3. Impacts of a project which are individually limited, but cumulatively considerable.

4. Environmental effects of a program which will cause substantial adverse effects on human beings, either directly or indirectly.

Geothermal activity becomes subject to the EIR requirement first by virtue of the fact that it is considered a discretionary project within the above definition, and, second, because certain of its operations could fall within the listed examples of change. The only avenue of exemption would be a negative declaration, on a case-by-case basis.

Only one EIR or negative declaration is required on a project and the actions of all responsible agencies must be governed by it. However, CEQA deems geothermal exploratory projects to be a separate and distinct project from any subsequent geothermal field development. Where an EIR has been prepared on a project, no additional EIR is required unless there are substantial proposed changes which involve environmental impacts not considered in the initial EIR.

A single EIR may be employed to describe more than one project, if such projects are essentially the same in terms of environmental impact. Further, an earlier EIR prepared in connection with a previous project may be applied to a later project, if the circumstances of the projects are essentially the same. EIR's may be written in advance for entire programs or regulations, in order to prepare for project applications to come. Whenever these alternatives are utilized, however, the environmental effects of the projects must be similar enough to warrant the same treatment in an EIR, and the EIR must adequately cover the impacts of any single project. If these tests are not met, the EIR prepared for a program should be supplemented so that it applies to an individual project.

Where individual projects are, or a phased project is, to be undertaken and where the total undertaking comprises a project with significant environmental effect, a single EIR must be prepared for the ultimate project. Where an individual project is a necessary precedent for action on a larger project, or commits an agency to a larger project, an EIR must address itself to the scope of the larger project. Where one project is one of several similar projects, but is not deemed a part of a larger undertaking or a larger project, either one EIR for all projects or one for each project may be prepared but in either case comment should be made upon the combined effect.

In cases where a project will require both a California EIR and an Environmental Impact Statement (EIS) under the National Environmental Policy Act, the EIS may be used in lieu of the EIR if it complies with the state guidelines. If the EIS is used, discussion of mitigating measures and growth-inducing impact must be added or supplemented if the EIS discussion of these elements is inadequate.

Lead Agency--In many instances, including geothermal development, a project requires approval by more than one public agency. In this case, a "Lead Agency" is designated to take the principal responsibility for preparing environmental documents and for approving a project. All other agencies concerned must consider the Lead Agency's EIR or negative declaration before initiating their own action on the project.

In the case of nongovernmental activity, the Lead Agency is the public agency with the greatest responsibility for supervising or approving the project as a whole -- i.e., an agency with general governmental powers rather than an agency with a single or limited purpose. Under current law, as described above, the Oil and Gas Division is the Lead Agency for exploratory geothermal drilling, the counties are the Lead Agency for field development drilling, and the State Energy Commission carries out this function for power plant construction, unless counties prepare an approved geothermal element in their general plan, in which case they may assume leadership for all three phases.

The Lead Agency is directed to consult with all other responsible agencies before completing its draft EIR or negative declaration, and subsequently to seek interagency review of its document and comment from persons with special expertise.

EIR Process--If, after its initial study, the Lead Agency finds that the proposed project may have a significant effect on the environment, the Lead Agency must prepare an EIR or have one prepared by an outside contractor or by an applicant. In either case, the agency is entirely responsible for its adequacy and objectivity. A Lead Agency is authorized to collect a reasonable fee to defray its own costs for preparing an EIR or negative declaration when the project requiring one is proposed by an applicant outside the agency -- i.e., an applicant is required to pay the cost of a contractor.

If the Lead Agency prepares either an EIR or negative declaration or has it done by a contractor, the agency may require the applicant to furnish all necessary data and information. As noted above, if this takes the form of a draft EIR, it must be reviewed and amended as needed so that it reflects the independent judgment of the Lead Agency.

Only the highlights of the mandated contents of an EIS are summarized briefly here. The reader who requires more detail is referred to Article 9, Title 14.

The precise location and boundaries of the proposed project are to be shown both on a detailed map and on a regional map. The project's objective and technical, economic, and environmental characteristics must also be stated. However, it is noted that extensive detail beyond that needed for evaluation and review of the environmental impact is not necessary.

The local and regional environmental setting of the proposed project must be described with emphasis on resources rare or unique to the region and with specific reference to related projects which might engender a cumulative impact. The following aspects of environmental impact must be specifically addressed:

1. Direct and indirect
2. Short-term and long-term
3. Specifics of the area
4. Resources involved
5. Physical changes
6. Alterations to ecological systems
7. Changes in population distribution and concentration (commercial and residential)
8. Changes in water and scenic quality and public services

Adverse environmental impacts must be described, including those which can be reduced, but not eliminated, along with reasons for proposing the project, its effects notwithstanding. Measures to mitigate adverse effects and alternatives, where available, are to be outlined including identification of the levels of reduction.

Alternatives to the project itself or its location must be described, including those which would substantially impede project objectives and are more costly. The specific alternative of "no project" and its impact must always be evaluated. Any irreversible environmental changes, such as use of non-renewable resources and growth-inducing impacts, must also be discussed.

Water quality aspects of the proposed project, including those which have been previously certified by the appropriate state or interstate agency as being in substantial compliance with applicable water quality standards, must be specifically described.

When the draft EIR is completed the Lead Agency must consult with and obtain comments from public agencies with jurisdiction by law with respect to the proposed project and should consult with special relevant expertise. In addition, an opportunity for comment by the general public should be provided, and public hearings may be held. (Underlining is added for emphasis on the precise connotation of each of these terms. According to Section 15015 of the guidelines, "must" identifies a mandatory element; "should" implies policy considerations and means that the action should be taken in the absence of compelling, countervailing considerations; and "may" identifies a permissive element which is left fully to the discretion of the public agencies involved. (There is a major distinction here as discussed below under "Public Participation.")

The Lead Agency then must evaluate the comments of all reviewers and prepare the final EIR. The final document contains the draft EIR or a revision; comments and recommendations received or a summary thereof; a list of reviewers; and the responses of the Lead Agency to significant environmental points raised. If a project is approved, a Notice of Determination is filed. Each responsible agency shall consider the Lead Agency's final EIR before acting upon or approving the subject project.

Timing of EIR Procedures--Several statements regarding the timing of implementing EIR requirements are noteworthy. The first of these is that public agencies should carry out their responsibilities for preparing and reviewing EIR's within a reasonable period of time. Further, Section 15054 states that the requirements for the preparation of an EIR should not cause undue delays in the processing of applications for permits or other entitlements to use. (Emphasis added.)

Section 15160 requires that the Lead Agency provide adequate time for review of an EIR by other agencies and the public. Review periods of not less than 30 nor more than 90 days except in unusual circumstances are suggested for draft EIR's. It is noted specifically, however, that a review period of an EIR does not require a halt in other planning activities related to a project. (Emphasis added.) Planning should continue in conjunction with an environmental evaluation.

If a reviewer (agency or person) fails to comment within a reasonable time as specified by the Lead Agency and does not seek an extension, it shall be assumed that the agency or person has no comment to make.

Public Participation--While public hearings are not made mandatory as discussed above, and are not required by the Environmental Quality Act of 1970, the guidelines stress that wide public involvement, both formal and informal, is a desirable goal. All agencies should make provision for such procedure in order to properly review and evaluate public reactions, adverse and favorable, based on environmental issues. No timeframe is suggested.

Alaska

The Department of Environmental Conservation reviews and comments on projects that may potentially affect the state's environment. The state has no environmental impact act.

Arizona

"Requirements for Environmental Impact Statements" are followed by the Arizona Fish and Game Commission in the preparation of an EIS. Essentially, the outline is a reiteration of the major category headings of the Council on Environmental Quality (CEQ) EIS guidelines.

Colorado

A sunshine law in Colorado enables the public to attend hearing and comment on any state action, including geothermal leasing. No environmental quality act has been enacted.

Hawaii

Hawaii established its Environmental Quality Commission (Chapter 343, Hawaii Revised Statutes) in 1974. An environmental impact statement is required if an action would have significant effects and utilize state or county funds or lands. This is particularly applicable to lands in a conservation district as specified by the State Land Use Commission; lands within the shoreline area or within 300 feet seaward of the shoreline area; lands within any historic site as designated in the National or Hawaii Register, and lands within the Waikiki-Diamond Head area of Oahu. The agency with initial jurisdiction over a proposed action must make threshold determinations and then submit a request for an EIS to the Commission. If the Commission then determines that an EIS is needed, the EIS is prepared and reviewed by the public. The governor or the mayor of the county involved then makes a final determination as to the environmental acceptability of the proposed action.

If both NEPA and the state's act apply, the draft statement has to be submitted to the Hawaii Environmental Quality Commission 30 days prior to submission to CEQ. The final impact statement also is reviewed and approved by the Commission. Feasibility or planning studies are exempted from the EIS requirement.

Rules and regulations implementing Chapter 343 were issued in 1975.

Idaho and Louisiana

No environmental impact requirements.

Montana

The Montana Environmental Quality Council issued "Revised Guidelines for Environmental Impact Statements Required by the Montana Environmental Policy Act of 1971" in 1975 (MAC, Title 26, Chapter 2). A policy statement preceding the MEPA rules requires that "In order to fulfill the stated policy of that Act, the department (Department of Health and Environmental Services) shall conform to the following rules prior to reaching a final decision on actions covered by MEPA." The policy statement also notes that the Act requires state agencies to comply with its terms to the fullest extent possible.

Environmental impact statements are to be prepared on proposals for projects, programs, legislation, and other major actions of state government significantly affecting the human environment. The following criteria normally require the preparation of an EIS:

1. The action may significantly affect environmental attributes recognized as being endangered, fragile, or in severely short supply.

2. The action may be either significantly growth-inducing or growth-inhibiting.

3. The action may substantially alter environmental conditions in terms of quality or availability.

4. The action may result in substantial cumulative impact.

The steps of EIS preparation and review procedures set forth are very similar in objectives to the California guidelines described in detail above.

Nevada

No environmental guidelines have been issued pursuant to Chapter 311 of 58 Nevada Revised Statute Laws of 1971.

New Mexico

In 1973, the state suspended its Environmental Quality Act of 1971 in order for the legislature to enact a new environmental policy act. To date, no such action has occurred. Thus, information on the potential environmental impact of new construction is obtained through the permitting process. For example, a conditional air pollution construction permit may require submittal of this kind of information before a final permit is issued.

Oregon

Oregon has no environmental impact legislation. However, the Department of Environmental Quality may "advise, consult, and cooperate" with other agencies in matters pertaining to protection and enhancement of Oregon's environment.

Texas

The Texas NEPA-type requirements are contained in "The Environment Policy-Guidelines and Procedures for Processing EIS's" adopted by the Interagency Council on Natural Resources and the Environment in 1975. This is an updated version of the original 1972 "Policy for the Environment" enunciated in "Environment for Tomorrow: The Texas Response." The policy solicits interagency cooperation and review of participants in order to minimize the environmental effects of a proposed activity and to develop alternatives that would abate environmental problems.

Utah

Each state agency within Utah is required, via an Executive Order issued in 1974 by the Governor, to issue an EIS for every state action it proposes or is administratively responsible for. An Environmental Coordinating Committee ("ECC") was established to advise, oversee, and review environmental impact statements by the relevant state agencies. The ECC's comments and determination as to the significance of the impacts are then forwarded to the Economic and Physical Development Interdepartmental Coordination Group, which will then repeat the procedure followed by the ECC. The Governor is then informed of these determinations and approves or rejects the findings. The proposing state agency is responsible for any EIS preparation and for submission of said document to the above-mentioned parties. "Significant" includes impact of mineral resource development, from archaeological impairment, or any environmental factors deemed to be important by a public agency. Private party actions are exempt unless a state agency is involved in licensing or funding.

Washington

The Environmental Policy Act of 1971 (Revised Code of Washington, Chapter 43.21C (Suppl. 1973) was enacted and amended with Chapter 179 of the Laws of 1974. It is implemented by "Guidelines Interpreting the State Environmental Policy Act, Chapter 463-46 WAC."

All branches of the state government, including municipal corporations, fall within the jurisdiction of the Act. If a government agency takes action with respect to a private or state party and the action is major and significantly affects the quality of the environment, an environmental impact statement has to be prepared.

The guidelines are very similar to the Federal NEPA guidelines. All policies and laws of the State are to be administered in accordance with the Environmental Policy Act. Separate agencies are requested to issue internal guidelines so as to facilitate the environmental review process. Threshold decisions are required for determination of whether an EIS is necessary. The Washington Council on Environmental Quality oversees the implementation and enforcement of the Act. The lead agency in this procedure for private geothermal resources projects is the Department of Natural Resources although a new Energy Facility Site Evaluation Council serves in this role for conventional power plants of 250 mw or more capacity.

The Shoreline Management Act (Chapter 286, Laws of 1971) can necessitate preparation of an EIS if the environment of the shore would be impacted adversely. There are no specific EIS requirements, yet the permitting process is used to evaluate environmental impacts.

Wyoming

Wyoming Industrial Development and Siting Act--

Construction of any energy generating plant designed for, or capable of, generating 100 MW of electricity or more is subject to approval by the Industrial Siting Council. Inherent in the approval process is an evaluation of the environmental impact of the new construction and of plans for alleviating adverse impacts. Factors which must be taken into consideration include the following:

- scenic resources
- recreation resources
- archaeological and historical resources
- land use patterns
- economic base
- housing
- transportation
- anticipated growth of satellite industries
- sewer and water facilities
- solid waste facilities
- police and fire facilities
- educational facilities
- health and hospital facilities
- water supply
- other relevant areas

AIR POLLUTION

A review of the air pollution regulations of 14 states and four counties in California with known geothermal resources has substantiated the fact that many of their provisions are similar to each other and identical in some cases. There are several reasons for this. In addition to the degree of uniformity engendered by Federal requirements, states have adopted model provisions drafted by various organizations other than EPA and its predecessors. Another reason is the proclivity of jurisdictions to adopt the environmental controls of another. Much of the language in general air pollution usage today derived from the Los Angeles County regulations where regulation of this type began. Thus, it was not surprising to find that the many state documents reviewed lend themselves to a large degree to general summaries applicable to all, with individual summaries limited to those areas of individual interest.

This similarity also points to the conclusion that potential geothermal developers are not likely to find a state which is an air pollution control "haven," so to speak, at least insofar as the language and numerous limitations of the regulations are concerned. The history of environmental regulation indicates very strongly that what one state imposes today may very well be specifically adopted by another tomorrow, as suggested above, and may be imposed today under discretionary authority.

The summaries do not dwell on those provisions of air pollution regulation which are more general in nature. Procedures, as such, are omitted, including hearing procedures. Hearings are provided for by most states and EPA at almost any point in the regulatory process when they are in the interest of the operator and/or the public. This assurance is virtually guaranteed in states with NEPA-type statutes.

Permits

All states require some form of permit for the construction, modification, and operation of sources or potential sources of air pollution. In addition, sources existing at the time the regulations are promulgated are often subject to a registration system which serves essentially the same purpose as the permit for a new or modified source. Whatever the nomenclature, the requirements are very similar.

The information required is quite comprehensive. It may include any or all of the following: a description of the production processes and related flow chart; a plat plan showing the height and location of all air contaminant sources and location of the nearest residential or commercial property; type and quantity of fuels used; amount, nature, and duration of emissions; estimated efficiency of control equipment under present or anticipated operating conditions; evidence that the emissions will not cause the national ambient air standards or NSPS to be exceeded, or, alternatively, an abatement schedule which will bring emissions into compliance; evidence that the proposed facility will not cause significant deterioration of existing air quality or exceed an increment in PSD areas; evidence that it is located in accordance with official land use planning; certification that it will utilize the best available control technology; and installation of monitoring equipment.

Some of these requirements could be far less innocuous for potential geothermal operators than for established industries because of the unknowns, or at least uncertainties, surrounding several of the facts which must be provided. For example, emission character and control equipment efficiencies will be difficult to forecast accurately until wells have been drilled and tested.

Variances

Variances from air pollution regulatory requirements are provided for in most of the regulations reviewed, although it was noted that this is not the case in those of Alaska, Arizona, and Colorado, although Title 46 of the Laws of Alaska provides the authority for variances in that state. Requests for variances are generally on the basis that compliance with a given requirement or requirements would cause an unreasonable hardship. This claim must be factually supported. The control agency then must determine the relative advantages and disadvantages to the public of the proposed variance vs. an order for compliance.

Particulate Standards

Only one particulate standard specifically applicable to geothermal operations was found in the survey of the particulate emission standards of the states subject to this report. It is discussed below in connection with the California air pollution control regulations. Otherwise, the survey indicates that the question of applicability of a number of them to geothermal operations may hinge on the interpretation of the term "process." In the preponderance of the regulations, particulate control is aimed primarily at fossil fuel-burning installations, refuse burning, and manufacturing processes. The first two are clearly not applicable, unless in the first case coal, oil, or gas is burned as a peaking or support source of energy. Process is generally defined, if at all, as an activity in which the physical or chemical characteristics of a material are altered.

District heating systems which mostly circulate hot water would not likely be the source of airborne particulates in any event and would certainly not meet this definition even if there were particulate emissions. However, the drilling and operation of the supporting wells may contribute this type of contaminant, but it is difficult to define production of geothermal fluids as a "process" unless flashing of the hot liquid as it nears the surface constitutes physical change of a material. Similarly, it can be questioned whether the use of the resource in power generation can be classified as a process.

These sources would be covered by other regulations. however. For example, in the Texas regulations "persons" are prohibited from causing, allowing, or permitting particulate emissions other than those authorized by the regulations. Wyoming and Arizona apply a general standard to "sources" of particulates, and Oregon provides a standard for sources other than fuel-burning and refuse-burning equipment.

In any event, the purpose of this discussion is not to suggest that particulate emissions will not have to be controlled, under a general statutory edict against air pollution or otherwise. However, the discussion does point up that some of the standards discussed below may or may not be deemed to be applicable except to industrial processes.

Beyond this variation, the survey showed a great deal of similarity in approach although some variance in stringency. Nine of the states and some

California Air Pollution Control Districts (APCD) base a particulate emission limitation which would be applicable to geothermal power plants on process weight per hour. In most cases, "process weight" means the total weight of all materials introduced into a specific process which may cause particulate emissions. The State of Wyoming, however, has excluded "the weight of any water, water vapor, or steam." Hawaii's regulation also excludes the weight of "liquid and gaseous fuels."

Equations are furnished for calculating maximum emission rates for process industries with a process weight of 2,722 kg (60,000 lb) per hour or less and for those with a process weight greater than 2,722 kg (60,000 lb) per hour. In the less stringent regulation used by six western states and Louisiana, the equations are as follows for the smaller and larger processes respectively:

$$E = 4.10\ P^{0.67} \text{ (smaller)}$$

$$E = 55.0\ P^{0.11} - 40 \text{ (larger)}$$

where: E = the maximum allowable particulate emissions rate in kilograms (pounds)-mass per hour; and P = the process weight rate in kkg (tons)-mass per hour.

This works out to an emission rate of approximately 1.23 kg (2.75 lb) of particulate matter for the first 450 kg (1,000 lb) of process weight per hour ranging up to 31 kg (69 lb) at 450,000 kg (1,000,000 lb) process weight per hour. This standard is employed in Idaho, Montana, Nevada, Oregon, for existing sources in Wyoming, and Arizona for areas outside Phoenix and Tucson. It is also used in the APCD's in which Lake, Mendocino, Sonoma, and Imperial Counties are located in California although there is some variation in application -- for example, in the Northern Sonoma County regulations the equation shown here for use with the small process weight -- 2,722 kg (60,000 lb) per hour or less is applicable for all weights. The same is true of the Hawaii standard.

For Phoenix/Tucson in Arizona and new sources in Wyoming, and in Colorado, and Washington the equations become more stringent as follows:

$$E = 3.59\ P^{0.62}$$

$$E = 17.31\ P^{0.16}$$

The hourly emission rate then drops to about 1.02 and 21.2 kg (2.25 and 46.72 lb) per hour, respectively, for the smaller and larger sources, discussed above. The Texas regulation is considerably more lenient than those derived by either of the above sets of equations for facilities with certain stack heights, although the allowable emission rate is reduced if the height is less than specified.

Other states impose a particulate emission standard based on grains per standard cubic foot of dry exhaust gas. In Oregon and Washington State, the standard is 0.1 grains, and Alaska applies an 0.05 grain limitation.

New Mexico's particulate emission standards are all industry-specific and do not specify geothermal operations of any type, although geothermal energy could potentially be used in many of the industrial applications to which the standards do apply. The Utah particulate limitations are even more specific in that they are applied on an individual plant basis.

Another form of particulate control is a limitation on the darkness or opacity of a plume. The limit in most of the states surveyed is No. 1 Ringelmann, although a few apply this only to new sources and permit up to No. 2 for existing sources. Since smoke is not a factor in geothermal operations, opacity is the controlling interest. However, in most states, when opacity exceeds the standard because of the presence of uncombined water or condensing water vapor, this is not a violation. This is a benefit to geothermal operations since geothermal plumes are condensed vapor. Some states, such as Nevada and Washington, put the burden of proof on the operator and others do not.

The ambient air quality standards reviewed for particulate matter are rather stringent in that many of them go beyond Federal requirements. The Federal standards are as follows:

Primary	μg/m^3
Annual geometric mean	75
Max. 24-hour concentration not to be exceeded more than once per year	260
Secondary	
Annual geometric mean	60
Max. 24-hour concentration not to be exceeded more than once per year	150

The various state standards compare as follows:

- Colorado, Idaho, Louisiana, Texas, and Utah are identical.
- Alaska, New Mexico, Oregon, and Washington apply the Federal secondary standard only.
- Arizona and Nevada impose the primary annual mean and secondary 24-hour maximum concentration.
- California and Montana apply the secondary annual mean and an even lower 24-hour standard than the Federal secondary standard -- 100 and 200 μg/m^3 respectively.
- Both of Hawaii's standards are lower than the Federal secondary levels -- 55 μg/m^3 as the annual mean and 100 μg/m^3 for the 24-hour maximum.

Still another type of particulate control which will be of concern during the site preparation and drilling phases of geothermal development is the control of fugitive dust. Nearly all states require use, where possible, of water or chemicals for control of dust during the clearing of land, construction operations, and grading of roads. There are also various specific requirements for gravel use and paving and some numerical limits on dustfall. It is not necessary to spell out each of these here because, while they may constitute what an operator considers a nuisance in the series of environmental controls he finds he must undertake, there are no such requirements which could conceivably affect the pace of geothermal development.

Sulfur Dioxide Standards

Sulfur dioxide standards are variously expressed in parts per million (ppm), a volume-to-volume measurement, and micrograms per cubic meter (μgm^3), a weight-to-volume value. In the following discussion, standards promulgated in ppm are converted to $\mu g/m^3$, and vice versa. The reference conditions assumed for the conversions are those upon which the federal SO_2 ambient air standards are based -- 25°C (77°F) and 760 mm of mercury (14.7 psi). These precise values are not uniformly used by all states as standard conditions -- for example, 21°C (70°F) and 15.6°C (60°F) are used by Alaska and Arizona, respectively, so some conversions are approximate only, although close enough for the comparative purposes of this report.

In several of the states surveyed there are no emission standards on sulfur oxides which could be interpreted as applicable to geothermal production or use. This is because the emission standards for this pollutant are geared strictly to combustion of fuel or to specific industries. No applicable SO_2 emission standard was found in Colorado, Hawaii, Louisiana, Montana, New Mexico, Oregon, or Wyoming. Utah simply requires new installations with a potential for emitting sulfur compounds to avoid exceeding the national primary and secondary ambient air standards and new source performance standards and existing installations to control sulfur emissions in such a manner that the standards shall never be exceeded.

Another type of emission standard limits the SO_2 concentration in the exhaust gas leaving the stack. The Washington State emission limit of this type is 2,667,000 $\mu g/m^3$ (1,000 ppm) as is that of Lake and Sonoma Counties, California. Louisiana has continued a 5,334,000 $\mu gm/^3$ (2,000 ppm) limit.

The Nevada sulfur emission standard is somewhat more complex and reads as follows:

> "No person shall cause, suffer, allow, or permit the emission of sulfur compounds where the sulfur originates in the material being processed (excluding sulfur from all solid, liquid, or gaseous fuel), in excess of the quantity determined by the following equation:

$E = 0.271 P^{0.904}$ $(0.292 P^{0.904})$
when E is equal to or greater than 5 kg (11 lb) per hour.

Where: E is the allowable sulfur emission in kilograms (pounds) per hour.
P is the total feed sulfur in kilograms (pounds) per hour."

It is to be noted that this standard excludes sulfur compounds which derive from sulfur in liquid and gaseous "fuels" because they are covered in another regulation related to burning. The Texas regulations have a sulfur dioxide emission standard for liquid fuel "fired" steam generators. It will be interesting to observe how the terms "liquid," "gaseous," and "fuels" will be interpreted if they must be applied to geothermal or geopressured power plants.

In Arizona, reduced sulfur emissions -- including sulfur dioxide, sulfur trioxide, and sulfuric acid -- are limited to 10 percent of the sulfur entering the process as feed.

In some cases, the state ambient air standards for sulfur oxide are somewhat more restrictive than the Federal standards which are:

Primary
Annual arithmetic mean - 80 $\mu gm/^3$ (0.03 ppm)
Maximum 24-hour concentration - 365 $\mu gm/^3$ (0.14 ppm)

Secondary
Maximum 3-hour concentration - 1,300 $\mu gm/^3$ (0.50 ppm)

Colorado, Nevada, Oregon, and Wyoming have reduced the annual mean to 60 $\mu gm/^3$ (0.02 ppm), some of the others are slightly lower than the Federal primary standard, and others went along with the above values. Hawaii is by far the most restrictive with a mean limitation of 20 $\mu gm/^3$ (.008 ppm) and a 24-hour peak maximum of 80 $\mu gm/^3$ (0.03 ppm).

Hydrogen Sulfide Standards

Four of the 15 states covered by this report have a hydrogen sulfide ambient air standard, two have promulgated H_2S emission standards, and three others have some type of standard on total reduced sulfur (TRS) compounds which could impact geothermal operations. All of these standards are set forth in the footnotes of Table V-4. As discussed in Section III, there is no national ambient air quality standard for this pollutant.

Hydrocarbon Standards

The national primary and secondary ambient air standard for hydrocarbons, measured and corrected for methane, by a method set forth in an appendix to 40 CFR Part 50, is: 160 $\mu gm/^3$ (0.24 ppm) maximum three-hour concentration (6 to 9 a.m.) not to be exceeded more than once per year. Only two states were found to have lower limitations -- New Mexico at 0.19 ppm and Hawaii at 100 $\mu gm/^3$.

TABLE V-4. STATE H_2S STANDARDS APPLICABLE TO GEOTHERMAL DEVELOPMENT*

	Ambient Air	Emission	TRS[1]
Alaska	-	-	2
Arizona	-	-	3
California	4	-	-
Colorado	-	-	-
Hawaii	-	-	-
Idaho	-	-	-
Louisiana	-	-	-
Montana	5	-	-
Nevada	-	6	-
New Mexico	7	-	8
Oregon	-	-	-
Texas	-	9	-
Utah	-	-	-
Washington	-	-	-
Wyoming	10	-	-

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*Some H_2S standards are expressed in ppm and some in µgm/³. In order to convert one to the other for the benefit of comparison, standard conditions of 25°C (77°F) and 76 mm of Hg are assumed, although these values are not uniform throughout all state standards. Therefore, the conversions are approximate.

[1] Total Reduced Sulfur - includes some combination of hydrogen sulfide, mercaptans, dimethyl sulfide, dimethyl disulfide, or other organic sulfides. No effort is made to convert ppm to µgm/³ or vice versa because of the wide variation in substances which may comprise TRS.

[2] 50 µgm/³, 1/2-hr. max. not to be exceeded more than once/yr.

[3] H_2S emissions may not cause ambient levels to exceed 42 µgm/³ (0.03 ppm) by volume for any averaging period of 30 minutes or more at any occupied place beyond the premises on which the source is located.

[4] Less than 42 µgm/³ (0.03 ppm) as max. 1-hr. av.

[5] 70 µgm/³ (0.05 ppm), 1/2-hr. av. not to be exceeded more than twice/yr.; 42 µgm/³ (0.03 ppm) 1/2-hr. av. not to be exceeded more than twice/5 consecutive days.

[6] Emission of sulfur compounds where the sulfur originates in the material being processed (excluding sulfur from all solid, liquid, or gaseous fuel), may not exceed the quantity determined by the following equation:

$$E = 0.271\ P^{0.904} \quad (0.292\ P^{0.904})$$

when "E" is equal to or greater than 5 kilograms (10 pounds) per hour.

(Continued)

TABLE V-4 (Continued)

Where:

"E" is the allowable sulfur emission in kilograms (pounds) per hour.
"P" is the total feed sulfur in kilograms (pounds) per hour.

When "E" is less than 5 kilograms (10 pounds) per hour, the gas stream concentration shall not exceed 1,000 ppm by volume.

[7] 0.0010 ppm, 1-hr. av. (for the state except the Pecos-Permian Basin Intrastate Air Quality Control Region)

0.100 ppm, 1/2-hr. av. (for the Pecos-Permian Basin Intrastate AQCR)

0.030 ppm, 1/2-hr. av. (for within corporate limits of municipalities within the Pecos-Permian Basin Intrastate AQCR)

0.030 ppm, 1/2-hr. av. (for within 5 miles of the corporate limits of municipalities with a population greater than 20,000 and within the Pecos-Permian Basin Intrastate AQCR)

[8] 0.003 ppm, 1-hr. av. (for the state, except the Pecos-Permian Basin Intrastate AQCR, except for H_2S.

0.010, 1/2-hr. av. (for the Pecos-Permian Basin Intrastate AQCR, except for H_2S)

0.003 ppm, 1/2-hr. av. (for within corporate limits of municipalities within the Pecos-Permian Basin Intrastate AQCR, except for H_2S)

0.003 ppm, 1/2-hr. av. (for within 5 miles of the corporate limits of municipalities with a population greater than 20,000 and within the Pecos-Permian Basin Intrastate AQCR, except for H_2S)

[9] Emissions of H_2S from a source or sources operated on a property or multiple sources operated on contiguous properties may not exceed a net ground level concentration of 112 μgm/^{3} (0.08 ppm) averaged over any 30-minute period if the downwind concentration of H_2S affects a property used for residential, business, or commercial purposes.

Emissions of H_2S from a source or sources operated on a property or multiple sources operated on contiguous properties may not exceed a net ground level concentration of 168 μgm/^{3} (0.12 ppm) averaged over any 30-minute period if the downwind concentration of H_2S affects only property used for other than residential, recreational, business or commercial purposes, such as industrial property and vacant tracts and range lands not normally occupied by people. (See Appendix H for procedures for determining net ground level concentrations.)

[10] 70 μgm/^{3} (0.05 ppm), 1/2-hr. av. not to be exceeded more than twice/yr; 40 μgm/^{3} (0.03 ppm), 1/2-hr. av. not to be exceeded more than twice/5 consecutive days.

Nitrogen Dioxide Standards

The national primary and secondary ambient air quality standard for nitrogen dioxide, as set forth in 40 CFR 50.11, is 100 μgm/^{3} (0.05 ppm) for the annual arithmetic mean. (EPA's document, Air Quality Criteria for Nitrogen Oxides, indicates that 100 μg/m^3 converts to 0.08 ppm.) The standards in most state regulations reviewed are identical. Hawaii's annual mean is 70 μgm/^{3} (0.06 ppm) and a 24-hour standard of 150 μgm/^{3} (0.12 ppm) is also used. California does not employ the annual mean and instead imposes a 120 μgm/^{3} (0.10 ppm) maximum over any one-hour averaging period.

Carbon Monoxide Standards

The national primary and secondary ambient air quality standards for carbon monoxide are as follows:

	mg/m^3	(ppm)
Maximum 8-hour concentration not to be exceeded more than once per year	10	9
Maximum 1-hour concentration not to be exceeded more than once per year	40	35

Again, nearly all state standards reviewed are identical to the above values, with California and Hawaii the major exceptions. Hawaii's eight-hour value is only half the Federal level, and its one-hour standard at 10 mg/m^3 represents a 75% reduction. California employs a 12-hour averaging period rather than eight with a maximum of 11,400 μgm/^{3} (10 ppm); the value for its one-hour averaging period at 45,700 μgm/^{3} (40 ppm) is slightly higher than the national standard.

Ozone Standards

The national ambient air quality standard for ozone is 235 μgm/^{3} (0.12 ppm) maximum one-hour concentration not to be exceeded more than once per year. Five of the states have not raised this standard from the original national level of 160 μgm/^{3} (0.08 ppm), and California, Hawaii, and New Mexico are even lower than that.

Lead Standards

The national primary and secondary ambient air quality standard for lead is 1.5 μgm/^{3} (0.0015 ppm), maximum arithmetic mean averaged over a calendar quarter. This national standard was promulgated much more recently than the other six NAAQS, and only a few of the state regulations reviewed have been revised to reflect it. California and Nevada standards are identical with the above value, although New Mexico at 3.0 μgm/^{3} (0.003 ppm) and Montana at 5.0 μg/m^3 (0.005 ppm) are higher.

Odors

Odor regulations range from none at all, to non-specific ones, to the very stringent ones of Montana described earlier. The Idaho regulations contain an example of the non-specific type which it applies to all sources for which no other gaseous emission control regulations apply. It states:

> "No person shall allow, suffer, cause, or permit the emission of odorous gases, liquids or solids into the atmosphere in such quantites as to cause air pollution."

In others, prohibited odor is defined as one which is still detectable after a certain number of dilutions with odor-free air as determined by a scentometer or equivalent device. In the Wyoming regulations and those of Colorado applicable to residential and commercial areas, the number of dilutions is seven; in Nevada, it is eight. In Colorado, 15 dilutions are permitted in areas other than residential or commercial, and when the source of odor is a manufacturing process, the dilutions go up to 127. Frequently, the proviso is added to this type of regulation that two odor measurements within one hour separated by at least 15 minutes are necessary before the odor occurrence is considered a violation.

Air Pollution Episodes

The Clean Air Act requires the states to adopt plans for action when air pollution reaches levels determined to require an alert, a warning, or to constitute an emergency situation. Because of the more remote location of most geothermal resources, it is not anticipated that their development will become a major contributor to such situations in the foreseeable future. Nor are production and use operations likely to be affected by them.

STATE AIR POLLUTION CONTROL REQUIREMENTS

The brief descriptions of air pollution control requirements by state which follow are not intended to summarize entire sets of regulations. Instead, they point up interesting facets of regulations not included in the above summaries or set forth unusual provisions not found in the others. A list of air pollution control statutes and regulations for the 15 states subject to this report are shown in Table V-5. Implementing agencies are listed in Table V-2.

Alaska

Title 46, Chapter 3, Laws of Alaska, Water, Air, and Environmental Conservation --

Air pollution control in Alaska is authorized by the above title, and the Department of Environmental Conservation is given authority to both promulgate and implement regulations. Local air pollution control program requirements must be compatible with those of the state. In the absence of a municipal program or by reason of a deficient program, the state's air pollution program supersedes the local ordinances, regulations, and require-

TABLE V-5. STATE STATUTES AND REGULATIONS
Air Pollution Control

State	Statute	Regulation
Alaska	Title 46, Laws of Alaska, Water, Air, and Environmental Conservation	Alaska Administrative Code, Title 18, Environmental Conservation, Chapter 50, Air Quality Control
Arizona	Title 36, Arizona Revised Statutes, Chapter 14 - Air Pollution	Rules and Regulations for Air Pollution Control, Arizona Code, Title 9, Chapter 3
California	Recodification of California Air Pollution Control Laws, Chapter 957, Statutes of 1975	
Colorado	Title 25, Article 7, Colorado Revised Statutes 1973, Air Quality Control	Code of Colorado Regulations, Volume 5, Regulations No. 1-9; Common Provisions Regulation; Ambient Air Standards for Metropolitan Denver AQCR, State Air Pollution Control Areas, and the State of Colorado
Hawaii	Hawaii Revised Statutes, Chapter 342, Environmental Quality Law	Air Pollution Regulations, Environmental Laws and Regulations, Vol. II
Idaho	Environmental Protection and Health Act of 1972, Idaho Code, Title 39	Rules and Regulations for the Control of Air Pollution in Idaho
Louisiana	Louisiana Revised Statutes, Title 30, Chapter II, Environmental Affairs Act	Regulations, Environmental Control Commission
Montana	Title 75, Chapter 2, Montana Code Annotated, Clean Air Act of Montana	Air Quality Rules, Montana Administrative Code, Title 16, Chapter 14
Nevada	Title 40, Nevada Revised Air Statutes, Air Pollution Law	Air Quality Regulations
New Mexico	Chapter 277, Laws of 1967, as amended, Air Quality Control Act	Air Quality Standards and Regulations, Sections 100-130

TABLE V-5 (Continued)

Oregon	1977 Replacement Part, Oregon Revised Statutes of 1969, Air Pollution Control Laws	Chapter 340, Oregon Administrative Rules Compilation, Division 2, Air Pollution Control.
Texas	Article 4477-5 Vernon's Texas Civil Statutes, Clean Air Act	Air Pollution Control Regulations: General and Procedural Rules, Regulations I-IX
Utah	Title 26, Utah Code Annotated, 1956, Air Conservation Act	Air Conservation Regulations
Washington	Title 70, Washington Revised Code, Clean Air Act	General Regulations for Air Pollution Sources, Title 173, Washington Administrative Code and miscellaneous specific rules and regulations
Wyoming	Chapter 9.1, Articles 1-11, Wyoming Statutes, 1973 Cumulative Supplement, Environmental Quality Act	Rules and Regulations of the Department of Environmental Quality, Chapter 1, Air Quality Standards and Regulations

ments. The Department may retain control of a particular class of air contaminant source because (1) its complexity or magnitude is beyond the reasonable capability of local control authorities; or (2) it may be more efficiently and economically controlled at the state level.

The state has emergency powers to force immediate discontinuance of any activity which in the judgment of the Commissioner of the Department of Environmental Conservation presents an imminent or present danger to the health or welfare or would be likely to result in irreversible or irreparable damage to natural resources or the environment.

Title 18, Chapter 50, Alaska Administrative Code, Air Quality Control--
In addition to the ambient air quality standard for reduced sulfur compounds shown in Table V-4, there is an emission standard for this class of pollutants, expressed as H_2S on a dry basis, relating to such compounds emanating from kraft pulp mills. However, there is presently no H_2S emission standard applicable to other types of sources. This point is interesting here only to point up the fact that Alaska has prepared this kind of regulation in advance to meet the eventuality of kraft pulp mills, of which it currently has none, and that the same precaution has not been extended to potential geothermal operations.

The Department may require a special permit for new industrial facilities in areas of potential ice fog and the reduction of water emissions.

Arizona

Title 36, Arizona Revised Statutes, Chapter 14 --
The above title confers joint administration of the state's air pollution control program on the state Department of Health Services and county or multi-county air pollution control districts. The Department's Bureau of Air Quality Control serves as the promulgating and implementing agency in regulating major sources (those capable of emitting more than 75 tons of air contaminants per day) and mobile or portable sources which can be operated in more than one county. Otherwise, the authority of the department may be delegated to the county or multi-county districts, including the authority to promulgate and implement regulations. The state regulations are found in Title 9 of the Arizona Code.

Title 36 was recently amended to prohibit any state ambient air quality standard which is more stringent than the Federal standard for the same pollutant. A spokesman for the Bureau of Air Quality Control expressed the opinion that as long as there is no such Federal standard on hydrogen sulfide, one cannot be promulgated in Arizona since any standard would be more stringent than none.

Arizona Rules and Regulations for Air Pollution Control--
As noted in the above general discussion on emission limitations on particulate matter, these regulations impose much stricter limitations on this class of pollutant in the Phoenix-Tucson Air Quality Control Region than in the rest of the state. While there is some geothermal interest in the general vicinity of these metropolitan areas, the state's two KGRA's are not located within them.

California

Chapter 957, Statutes of 1975, Recodification of California Air Pollution Control Laws --

This statute gives to the State Air Resources Board in the Resources Agency the authority to control mobile sources emissions, although regulatory and enforcement powers over stationary sources are vested in air pollution control districts. The APCD's may embrace only one county or may be regional in scope. For example, the California North Coast Air Basin embraces the APCD's of Northern Sonoma County, where most of The Geysers operations are located, and Mendocino, Del Norte, Humholdt, and Trinity Counties, and one set of regulations applies to all, with a few provisions specific to one county.

However, the recently-revised hydrogen sulfide regulations applicable to geothermal power plants apply only to specified units at The Geysers and are shown in Table V-6, although those for steam transmission line stacking, well drilling, reworking, and testing as well as small source emissions are generally applicable as shown in Table V-7.

In addition, particulates from geothermal steam sources may not exceed the quantity established by the following formula:

$$y = .00069\ x + 1.4$$

where y is the particulate emission rate limitation in kilograms per hour (averaged over one hour) and x is the steam rate in kilograms per hour passing through a geothermal well drilling operation or any geothermal well being vented for clean-out.

The California state ambient air quality standards are shown in Table V-8. They are applicable statewide, with the exception of the Lake Tahoe Air Basin, and their achievement must be supported by adequate basinwide air pollution control standards as well as those of the APCD's. There are no other statewide air pollution control regulations in California.

Colorado

Title 25, Article 7, Colorado Revised Statutes (1973) --

This title constitutes Colorado's Air Pollution Control Act and gives the Air Pollution Control Commission, Department of Health, the power to adopt implementing regulations. Pertinent features of these which are not summarized above follow:

Code of Colorado Regulations, Volume 5, Air Pollution Control Commission Regulations --

The sulfur dioxide ambient air quality standards in these regulations are modeled after the PSD increment system in that they vary among the three classes of areas and are expressed as allowable amounts of increases in ambient concentration over an established baseline. The increments for Colorado's Category I are identical to the Federal increments for Class I areas discussed in Section III. However, those for Category II, which cur-

Table V-6. Hydrogen Sulfide Limitations on Emissions of Power Generating Units at the Geysers

Effective Date (Note #2)	GEOTHERMAL POWERPLANTS (NOTE #1 and #3)		
	Initially operated on or before March 31, 1979, (includes PG&E Geysers Units 1-12.	Initially operated after March 31, 1979, but initially issued an Authority to Construct or Determination of Compliance by March 31, 1980, (includes PG&E Geysers Units 14, 15, & 17 and NCPA #2).	Initially issued an Authority to Construct or Determination of Compliance after March 31, 1980, (includes all others).
January 1, 1979	For Units 3,4,5,6,11 & 12 emit no more than: 10% of the H_2S in the supplied steam at full power plant load or 200 g/hr/GMW average using allocation method (see notes #7).		
January 1, 1980		100 g/hr/GMW	100 g/hr/GMW
July 15, 1981	10% of the H_2S in the supplied steam at full load operation for Units 3,4,& 11 and 200 g/hr/GMW for Units 5, 6, & 12 (comply as shown or per Note #8).		50 g/hr/GMW
June 1, 1985	Units 1,2,3,4,5,6,7,9,10, 11 & 12: each at 200 g/hr/GMW (Comply as shown or per Note #8).	50 g/hr/GMW (Note #8).	
June 1, 1986	Units 1-12 each at 100 g/hr/GMW (Comply as shown or per Note #8).		

Table V-7. Hydrogen Sulfide Limitations on Emissions from other Sources at the Geysers

	STEAM TRANSMISSION LINE 1*, *6, *8, & *9 STACKING			
EFFECTIVE DATE	EXISTING OR PERMITTED SYSTEMS AS OF JUNE 1, 1978	NEW SYSTEMS	WELL DRILLING REWORKING AND TESTING	SMALL SOURCE EMISSION (KG/HR/SOURCE
Feb. 3, 1981	Upon an unscheduled outage an operator shall within four (4) hours or less reduce H_2S emissions: (a) by 90% or more for dual units or, (b) by 50% or more for single units or when both units of a dual unit system have a simulataneous outage or, (c) to not more than 15 kg/hr. For scheduled outage* the same emission standards shall be met within one (1) hour or less.	Upon an unscheduled outage an operator shall within four (4) hours or less reduce H_2S emissions: (a) by 90% or more for dual units or, (b) by 65% or more for single units or when both units of a dual unit system have a simultaneous outage or, (c) to not more than 15 kg/hr. For scheduled outage* the same emission standards shall be met within (1) hour or less.	2.5 kg/hr/ well Note *4	2.0 kg/hr per source Note *5
June 1, 1984	Upon an unscheduled outage an operator shall reduce H_2S emissions: a) by 99% or more at associated unit muffler within two (2) hours or less for dual units (other than units 1&2) or b) by 50% or more within two (2) hours or less and by 65% or more within four (4) hours or less for single units or when both units of a dual unit system have a simultaneous outage or, c) to not more than 20 kg/hr. For a scheduled outage the same emission standards for an unscheduled outage shall be met within one (1) hour or less. If more than one system (dual unit considered a single system) in the operator's field suffers unscheduled outages simultaneously the provisions of Rule 540(b) shall apply.			1.0 kg/hr. per source Note *5
Jan. 1, 1985				0.5 kg/hr per source Note *5
Dec. 31, 1986	Upon any outage the operator shall within ten (10) minutes or less reduce H_2S emissions to less than 39 kg/hr. In addition, for an unscheduled outage the operator shall within four (4) hours or less reduce H2S emissions: (a) by 90% or more or, (b) to not more than 20 kg/hr. For a scheduled outage the emission standards (a) and (b) for an unscheduled outage* shall be met within one (1) hour or less.			

NOTES FOR TABLES V-6 AND V-7

NOTE 1 All geothermal emission sources, including new construction, must comply with all applicable future emission rate limits specified in these tables as they become effective.

NOTE 2 H_2S emissions limitations for each category of emission source will become effective henceforth on the date indicated at the left of the Tables.

NOTE 3 The term "g/hr/GMW" shall read "grams/hr per Gross Megawatt". The rates of emission may be equaled but not exceeded. Gross Megawatt refers to the source's full load gross generating capacity of the turbine generator as guaranteed by the turbine generator manufacturer. Compliance shall be verified by the source testing or protocol method approved by the District for the applicable emission source(s) (see also note *8).

NOTE 4 Individual well emissions shall be limited to 2.5 Kg/hr/well unless a higher rate was determined by new source review or unless applicant provides data which subsequently can justify a re-determination of the emission rate by the Air Pollution Control Officer.

NOTE 5 Small sources include continuous well and pipeline bleeds. Allowable emissions are those shown in Table V-7 unless otherwise determined by the Air Pollution Control Officer.

NOTE 6 "Reduce H_2S by 50%" H_2S shall mean emit no more than 50% of the H_2S normally found in the supplied steam at full power load. "Dual Units" shall refer to those steam transmission lines associated with two power plant units located in the same building and therefore such associated steam transmission lines shall be considered as one source.

NOTE 7 Allocation method - If an emissions rate less than the required gm/hr/GMW is attained at one power plant unit the excess reduction (in grams) can be credited to another power plant unit or apportioned to other power plant units. For instance, a 10 megawatt plant can be allowed to emit 2,000 gm H_2S hr, but if a credit of 500 gm H_2S were allocated from another unit, it could emit 2,500 H_2S /hr or 250 gm/hr/GMW. The allocation should be modified no more than quarterly and only if needed based on new data. (The major purpose of the allocation method is for individual power plant unit compliance verification and credit for greater H_2S reduction than required.)

NOTE 8 Protocol Method - Each geothermal facility may be allowed to establish a protocol acceptable to the District which specifies the manner in which the facility will be operated to meet the emissions limitations set forth in Table V-6 and V-7. Each protocol shall specify if applicable:

1. the frequency and method of sampling the incoming steam quality and flow rates;
2. the frequency and method of adjusting chemical feed rate settings;
3. the frequency and method of instrument and testing equipment calibration;
4. the predicted relationship between incoming steam quality and flow rates, chemical feed rates, and H_2S emissions;
5. the frequency and method of emissions source testing;
6. data logging requirements;
7. the locations of all logs and source test records; and
8. the requirement that periodic source tests be performed.

Each operating protocol can be modified by mutual agreement between the District and the operator. Changes in operating protocol(s) shall not take effect until copies of the revised protocol(s) are filed at the District office and the facility. Compliance with the operating protocol approved by the Control Officer shall be deemed compliance with the H_2S emissions limitations of this rule.

The major purpose of the protocol method is to provide a practical means of compliance with the specified emissions limitations given variations in incoming steam quality, chemical abatement system performance, and emission source test accuracy. A form of transferable emissions credits or allocation (pound for pound) among specified power plants shall be allowed in the protocol(s) as long as in the opinion of the Control Officer that enforceability can be reasonably achieved and ambient air quality would not be substantially degraded.

NOTE 9 Stacking emission standards will be required of any steam transmission line or power plant which is expected to have on the average three (3) or more stacking events per year; the normal enforcement of equipment breakdown per rule 540 for the applicable stacking facility will be followed.

TABLE V-8. AMBIENT AIR QUALITY STANDARDS OF CALIFORNIA

Pollutant	Averaging Time	California Standards[1]		National Standards[2]		
		Concentration[3]	Method[4]	Primary[3,5]	Secondary[3,6]	Method[7]
Oxidant (Ozone)	1 hour	0.10 ppm (200 ug/m^3)	Ultraviolet Photometry	160 ug/m^3 (0.08 ppm)	Same as Primary Std.	Chemiluminescent Method
Carbon Monoxide	12 hour	10 ppm (11 mg/m^3)	Non-Dispersive Infrared Spectroscopy	-	Same as Primary Std.	Non-Dispersive Infrared Spectroscopy
	8 hour	-		10 mg/m^3 (9 ppm)		
	1 hour	40 ppm (46 mg/m^3)		40 mg/m^3 (35 ppm)		
Nitrogen Dioxide	Annual Average	-	Saltzman Method	100 ug/m^3 (0.05 ppm)	Same as Primary Std.	Proposed: Modified J-H Saltzman (O_3 corr.) Chemiluminescent
	1 hour	0.25 ppm (470 ug/m^3)		-		
Sulfur Dioxide	Annual Average	-	Conductimetric Method	80 ug/m^3 (0.03 ppm)	-	Pararosaniline Method
	24 hour	0.04 ppm (105 ug/m^3)		365 ug/m^3 (0.14 ppm)	-	
	3 hour	-		-	1300 ug/m^3	
	1 hour	0.5 ppm (1310 ug/m^3)		-	-	

TABLE V-8. Continued

Suspended Particulate Matter	Annual Geometric Mean 24 hour	60 ug/m^3 100 ug/m^3	High Volume Sampling	75 ug/m^3 260 ug/m^3	60 ug/m^3 150 ug/m^3	High Volume Sampling
Lead	30 Day Average	1.5 ug/m^3	High Volume Sampling Dithizone Method	-	-	-
Hydrogen Sulfide	1 hour	0.03 ppm (42 ug/m^3)	Cadmium Hydroxide Stractan Method	-	-	-
Hydrocarbons (Corrected for Methane)	1 hour (6-9 a.m.)	-	-	160 ug/m^3 (0.24 ppm)	Same as Primary Standards	Flame Ionization Detection Using Gas Chromatography
Ethylene	8 hour 1 hour	0.1 ppm 0.5 ppm	-	-	-	-
Visibility	1 Observation	In sufficient amount to (8) reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70%		-	-	-

TABLE V-8. Continued

NOTES:

1. California standards are values that are not to be equaled or exceeded.

2. National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent procedure which can be shown to the the satisfaction of the Air Resources Board to give equivalent results at or near the level of the air quality standard may be used.

5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency (EPA).

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.

7. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.

8. Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessary in continuous sectors.

rently embraces the entire state since there are no Category I or III areas, are almost 50 percent more stringent than the Federal Class II increments. They compare as follows:

	$\mu g/m^3$	
	Federal	Colorado
Annual arithmetic mean	20	10
24-hour maximum	91	50
3-hour maximum	512	300

Depending on how they are implemented, Colorado's odor regulations applicable to manufacturing processes outside the residential or commercial areas could be beneficial to geothermal development. While these require use of the best practicable treatment and control available for odor reduction, "best practicable" is not to be interpreted as "any method which would result in an arbitrary and unreasonable taking of property or in the practical closing of any lawful business or activity, if such would be without corresponding public benefit." However, this provision notwithstanding, odors strong enough to be detectable after dilution with 127 or more volumes of odor-free air are a violation.

Hawaii

Chapter 342, Hawaii Revised Statutes--
This statute confers air pollution control rulemaking authority on the Department of Health. The Department's regulations, contained in Volume II of the Hawaii Environmental Laws and Regulations, are administered by its Environmental Protection and Health Services Division.

Air Pollution Regulations, Environmental Laws and Regulations, Volume II--
As discussed above, the only Hawaii particulate regulation which could apply to geothermal operations of any type are those applicable to process industries. The term "process" is defined as any method, reaction, or operation whereby materials introduced into the process undergo physical or chemical change." Thus, it is unclear whether these regulations would apply to geothermal power plants, even if they would otherwise be classified as a "process industry," in instances where the fluid undergoes no change in character during use.

Idaho

Title 39, Chapter 39, Idaho Code--
This title is the Idaho Environmental Protection and Health Act of 1972 and confers upon the Board of Health and Welfare the authority to adopt rules and regulations for the control of air pollution in Idaho. Division of Environment, Bureau of Air Quality, in the Department of Health and Welfare is the implementing agency.

Rules and Regulations for the Control of Air Pollution in Idaho--
These rules set forth three ambient air quality standards of potential interest to the geothermal industry in addition to the seven required. These include:

Sulfuric Acid Mist:
Primary and secondary standards:
Maximum 24-hour concentration - 12 μg/m³ not to be exceeded more than once/month
Maximum 1-hour concentration - 30 μg/m³ not to be exceeded more than twice/week

Fluorides:
Primary and secondary air quality standards are those concentrations in the ambient air which result in a total fluoride content in vegetation used for feed and forage of not more than:
40 ppm dry basis - annual arithmetic mean
60 ppm dry basis - monthly concentration for two consecutive months
80 ppm dry basis - monthly concentration never to be exceeded

These standards will probably have no effect on geothermal operations.

Settleable Particulate:
Primary and secondary standards are:
0.8 mg/cm²/mo not to be exceeded more than 25 percent of the time

Louisiana

Title 30, Chapter II, Louisiana Revised Statutes--
This statute establishes an Office of Environmental Affairs to implement regulations promulgated by the Environmental Control Commission.

Regulations, Environmental Control Commission--
These regulations contain a unique emission standard on hydrogen sulfide emissions. It states: "All refinery process gas streams or any other gas stream that contains sulfur compounds measured as hydrogen sulfide shall be controlled by flaring or combustion." It would be difficult to apply such a regulation to the hydrothermal resource although the presence of methane in the geopressured resource in Louisiana might make this practice more feasible.

Montana

Title 75, Chapter 2, Montana Code Annotated--
This statute provides that the Board of Health and Environmental Services shall promulgate regulations to be implemented by the department of the same name through its Air Quality Bureau. Municipalities may take over control programs by petition of 15 percent of the qualified electors.

State of Montana Air Quality Rules, Title 16, Chapter 14, Montana Administrative Code--
The significant feature of the Montana regulations insofar as the geothermal industry is concerned is the very stringent odor control described above. The application of the only other similar standard found was limited to animal rendering plants. The oddity is, however, that as strict as the Montana regulations are in one sense, they do not define odor except as "that property of an emission which stimulates the sense of smell."

These regulations also contain another peculiarity in that they do not set forth ambient air quality standards for carbon monoxide, ozone, oxide of nitrogen, or hydrocarbons but include such standards for several other pollutants. The two of most interest here are H_2S as shown in Table V-4 and sulfuric acid mist as follows:

	$\mu g/m^3$
Annual average	4
Not to be exceeded over 1% of the time	12
Hourly average, not to to be exceeded over 1% of the time	30

Nevada

Title 40, Nevada Revised Statutes--

This statute establishes an Environmental Commission to promulgate regulations and a Department of Health and Environmental Services to implement them.

The Nevada regulations require the air pollution control agency to investigate an odor when 30 percent or more of a sample of the people exposed to it believe it to be objectionable in usual places of occupancy. (The sample is to include at least 20 people or 75 percent of those exposed, if fewer than 20 are involved.) Odors detectable after dilution with eight or more volumes of odor-free air occurring twice within an hour -- at least 15 minutes apart -- constitute a violation.

New Mexico

Chapter 277, Laws of 1967 as amended--

This chapter contains the New Mexico Air Quality Control Act. The New Mexico Environmental Improvement Act authorizes the Environmental Improvement Board to promulgate regulations pursuant to the Air Quality Control Act which are implemented by the Environmental Improvement Division of the Health and Environment Department.

Air Quality Control Regulations Sections 100 to 130--

These regulations contain ambient air quality standards for H_2S. The limitation is 0.010 ppm statewide except for the Pecos-Permian Basin where it is 0.100.

Oregon

1977 Replacement Part, Oregon Revised Statutes of 1969--

Under this statute, the Department of Environmental Quality administers the air pollution regulations adopted by the Environmental Quality Commission.

Oregon Administrative Rules, Chapter 340--

These regulations purport to impose very stringent state environmental standards upon Federal lands which are classified as wilderness areas under the national Wilderness Act, P.L. 88-577. Since geothermal activity will be precluded in those areas after January 1984, they will exert little effect.

Oregon has established Special Control Areas and within them a provision which may require capture of fugitive emissions which would otherwise be emitted through doors or windows and transfer to air pollution control equipment. These areas include the Willamette Valley, Umpqua Basin, Rogue Basin, and all incorporated cities with populations of 4,000 or more and within three miles of the corporate limits of any such city.

Texas

Texas Clean Air Act codified as Article 4477-5 --

The Texas Air Control Board has issued General Rules and a series of separate regulations for the control of air pollution under the above Act.

Control of Air Pollution from Visible Emissions and Particulate Matter--

These regulations contain a set of particulate emission standards which do not appear in the requirements of the other states surveyed. They prohibit emissions which exceed any of the following ground level concentrations:

100 $\mu g/m^3$ of air sampled, averaged over any five consecutive hours

200 $\mu g/m^3$ of air sampled, averaged over any three consecutive hours

400 $\mu g/m^3$ of air sampled, averaged over any one-hour period

Control of Air Pollution from Sulfur Compounds--

Maximum ground level concentrations of SO_2 are also set which vary over the state. They are 747 $\mu g/m^3$ (0.28 ppm) averaged over a 30-minute period in Galveston and Harris Counties, 853 $\mu g/m^3$ (0.32 ppm) in Jefferson and Orange Counties, and 1067 $\mu g/m^3$ (0.4 ppm) in the rest of the state with some exceptions in El Paso County. This means that the more stringent limitations are applied in the more industrialized areas.

The Texas H_2S standards are shown in Table V-4. As noted in Footnote 9 to that Table, Appendix H provides the procedures for determining net ground level concentrations of H_2S.

Sulfuric acid emissions may not exceed:

1. A net ground-level concentration of 15 $\mu g/m^3$ of air averaged over any 24-hour period; or

2. A net ground-level concentration of 50 $\mu g/m^3$ of air averaged over a one-hour period of time more than once during any consecutive 24-hour period; or

3. 100 $\mu g/m^3$ of air maximum at any time.

Utah

Title 26, Utah Code Annotated, 1956--

Air conservation regulations were adopted by the Utah Air Conservation Committee and the State Board of Health pursuant to the above statute which is Utah's Air Conservation Act. The Bureau of Air Quality, Division of Environmental Health in the Health Department, is the implementing agency.

Air Conservation Regulations--

The bulk of these regulations conforms very closely with those of other states with one notable exception. This is the exemption from permit requirement of exhaust systems for controlling steam and heat which do not contain combustion products. However, a spokesman for the Bureau stated that this provision was not intended to apply to geothermal operations.

Washington

Title 70, Washington Revised Code--

The Department of Ecology of the State of Washington promulgates and implements the state's air pollution control program pursuant to the above statute.

General Regulations for Air Pollution Sources, Title 173 Washington Administrative Code--

The Washington regulations offer another good example of a general, non-specific type of odor regulation. It reads as follows:

> "Any person who shall cause or allow the generation of any odor from any source which may unreasonably interfere with any other property owner's use and enjoyment of his property must use recognized good practice and procedure to reduce these odors to a reasonable minimum."

This provision was formerly applicable only when adjoining property was affected, but now has been extended to cover any other property.

Wyoming

Chapter 9.1, Articles 1-11, Wyoming Statutes, 1973 Cumulative Supplement--

The Wyoming regulations were promulgated pursuant to the above statute and are administered by the Division of Air Quality, Department of Environmental Quality.

Air Quality Standards and Regulations, Chapter 1--

These regulations apply sulfuric acid mist, sulfate, hydrogen sulfide, and fluoride ambient air quality standards in addition to those required by the Clean Air Act. The suspended sulfate limitation is 0.25 $mg/SO_3/100\ cm^2$, maximum annual average, measured as a sulfation rate by the lead peroxide method. The H_2S standards are shown in Table V-4.

The regulations also require that any exit process gas stream containing hydrogen sulfide which is discharged to the atmosphere from any source be vented, incinerated, flared, or otherwise disposed of in such a manner that ambient sulfur dioxide and hydrogen sulfide standards are not exceeded.

In defining the process weight per hour used to calculate allowable emissions under a particulate standard predicated on process weight, the Wyoming regulations expressly exclude "liquids or gases used solely as fuels" and "any water, water vapor, or steam that may be introduced as part of the total materials."

Effective odor control devices are required which will limit odors at the property line to those of sufficent strength to be equal to but no greater than that detectable after seven dilutions with odor free air as determined by a scentometer or of lower strength. Two measurements within one hour separated by at least 15 minutes are required.

WATER QUALITY

The Clean Water Act requires EPA to develop water quality criteria which accurately reflect the latest scientific knowledge on the kind and extent of all identifiable effects on health and welfare which may be expected from the presence of pollutants in any body of water or ground water. The criteria specify concentrations of water constitutents which, if not exceeded, will achieve the water quality which is desirable or necessary for specific uses. The water quality criteria are not enforceable standards in themselves but form the basis upon which state water quality standards are set.

In turn, in the absence of industrywide limitations on the actual amount of each pollutant which may be lawfully discharged by geothermal operations, the water quality standards will be used as the primary basis for calculating effluent limitations guidelines and new source performance standards imposed in the NPDES permit, the primary mechanism for controlling water pollution, as discussed earlier. Thus, the standards may assume an importance for this industry which may not attach as directly to those industries for which EPA has established guidelines and standards.

The standards consist of criteria -- i.e., limits on the concentrations of various parameters allowed in receiving streams or restrictions on changes in pH, temperature, or other characteristics of surface waters -- and a designated use for which the water body is to be protected. The criteria may be more stringent than the values in the Federal criteria if a state so desires.

The use classifications may include entire water bodies or may vary from reach to reach of the same stream. The separate water quality criteria applied to the specific classifications are designed to maintain the quality to support the use or uses or permit the attainment of that quality. These criteria vary in stringency according to degree of purity required for the designated uses.

The result of the separate stream classifications is that the calculated permit effluent limitations may vary, depending on where the discharge is to take place. The limitations could differ for operations even a few miles apart on the same stream.

The designated uses usually follow the Federal criteria rather closely and include some combination of the following:

- public water supplies
- recreation and aesthetics
- fish, other aquatic life, and wildlife
- agricultural use
- industrial use.

Some states employ even further breakdowns. A common one is differentiation among waters suitable for potable purposes with: (1) only simple disinfection; (2) after removal of naturally-occurring parameters; and (3) after treatment equal to coagulation, sedimentation, filtration, and disinfection. The criteria graduate to less stringency with less demanding designated uses.

The most recent Federal criteria (Federal Register, 28 November 1980) address the 65 pollutants identified by EPA as toxic under Section 307(a)(1) of the Clean Water Act. These criteria supersede any previous criteria for these substances. The criteria for all other pollutants and water constituents found in an earlier publication on this subject, Quality Criteria for Water, the so-called "Red Book", remain valid. They are identified below.

The criteria for the toxics, derived using revised methodologies called "Guidelines" which were also published in the Federal Register of 28 November 1980, introduce a completely new level of stringency on the concentrations considered acceptable to protect human health and aquatic life. In fact, many of the values are so small that they are expressed in nanograms rather than the traditional milligrams or the microgram criteria usage introduced for the first time in the "Red Book" in 1976. A nanogram is a billionth of a gram; a microgram is a millionth of a gram; and a milligram is one-thousandth.

Table V-9 was prepared to show the relative stringency of some of the new criteria by converting them from nanograms and micrograms to milligrams, the standard usage in state water quality standards. The criteria are not rules and have no regulatory impact, although EPA encourages the states to begin to modify or, if necessary, to develop new standards to reflect this degree of control of toxic pollutants. If they do so, some very rigid effluent limitations could be derived from them. It will not be necessary for each state to set standards on all the toxic pollutants. It is EPA's present plan to assist them in identifying specific toxics for possible inclusion in the water quality standards of individual states. States will have the option of adopting the published criteria or of adjusting those criteria on a site-specific basis.

TABLE V-9. COMPARISON OF SELECTED FEDERAL WATER QUALITY CRITERIA FOR TOXIC POLLUTANTS TO PREVIOUS CRITERIA AND TYPICAL STATE WATER QUALITY STANDARDS (microgram and nanogram values converted to milligrams) (mg/l)

Pollutants	Freshwater Aquatic Life			Saltwater Aquatic Life			Human Health		
	New Criteria	Red Book	State	New Criteria	Red Book	State	New Criteria	Red Book	State
Arsenic	0.44	-	0.05	0.05	-	-	Preferably 0[a]	0.05	0.05
Beryllium	0.13 (acute toxicity) 0.0053 (chronic toxicity)	0.011 (soft water) 1.1 (hard water)	-	-	-	-	Preferably 0[b]	-	
Cadmium	Variable with hardness[c]	0.0004 (soft water/ salmonid fishes) 0.004 (soft water/ less sensitive fishes) 0.0012 (hard water/ salmonid fishes) 0.012 (hard water/ less sensitive fishes)	0.003	0.0045 (24-hr. av.) 0.059 (max. concentration)	0.005	-	0.01	0.01	0.01
Hexavalent Chromium	0.00029 (24-hr. av.) 0.021 (max. concentration)	1.0	0.02	0.018 (24-hr. av.) 1.26 (max. concentration)	-	-	0.05	0.05	0.05
Copper	0.0056 (24-hr. av.) max. concentration variable with hardness[d]	Bioassay dependent	0.05 (Oregon, 0.005)	0.004 (24-hr. av.) 0.023 (max. concentration)	-	-	1.0 for controlling taste & odor quality of ambient water	1.0 for controlling taste & odor quality of ambient water	1.0
Lead	Variable with hardness[e]	Bioassay dependent	0.05	0.668 (acute toxicity) 0.025 (chronic toxicity)	-	-	0.05	0.05	0.05

Continued

TABLE V-9. Continued

Pollutants	Freshwater Aquatic Life			Saltwater Aquatic Life			Human Health		
	New Criteria	Red Book	State	New Criteria	Red Book	State	New Criteria	Red Book	State
Mercury	0.0000005 (24-hr. av.) 0.0000017 (max. concentration)	0.00005	0.00005	0.000025 (24-hr. av.) 0.0037 (max. concentration)	0.0001	-	0.000144 (0.000146 for injestion of of aquatic organisms alone)	0.002	0.002
Selenium	0.035 (24-hr. av.) 0.26 (max. concentration)	Bioassay dependent	0.05	0.054 (24-hr. av.) 0.41 (max. concentration)	-	-	0.01	0.01	0.01
Zinc	0.047 (24-hr. av.) max. concentration variable with hardness f	Bioassay dependent	0.01	0.058 (24-hr. av.) 0.17 (max. concentration)	-	-	5.0 for controlling taste & odor quality of ambient water	5.0 for controlling taste & odor quality of ambient water	5.0

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[a] Since zero level for certain carcinogens may not be obtainable at this time, EPA has estimated the levels which may result in incremental increase of cancer risk over the lifetime. The increments used for beryllium were 10^{-5}, 10^{-6}, and 10^{-7}, or one additional case of cancer in populations ranging from 10 million to 100,000 respectively. The corresponding criteria are: 0.000022 mg/l, 0.0000022 mg/l, and 0.00000022 mg/l. If these estimates are made for consumption of aquatic organisms only, excluding consumption of water, the levels are 0.000175 mg/l, 0.0000175 mg/l, and 0.00000175 mg/l, respectively.

[b] At increments of 10^{-5}, 10^{-6}, and 10^{-7}, the corresponding criteria are 0.000037 mg/l, 0.0000037 mg/l, and 0.00000037 mg/l. For consumption of aquatic organisms only, the levels are 0.00641 mg/l, 0.0000641 mg/l, and 0.0000064 mg/l.

[c] The criterion for the 24 hour average in mg/l $e^{(1.05 [\ln (\text{hardness})] - 8.53)}$; the concentration in mg/l should not exceed the value given by $e^{(1.05 [\ln (\text{hardness})] - 3.73)}$. For example, at hardnesses of 50, 100, and 200 mg/l as $CaCO_3$, the criteria are 0.000012, 0.000025, and 0.000051 mg/l respectively, and the concentration should not exceed 0.0015, 0.003, and 0.0063 mg/l, respectively.

[d] The maximum concentration should not exceed the value given by $e^{(0.94 [\ln (\text{hardness})] - 1.23)}$. For example, at the above hardnesses of $CaCO_3$, the concentration should not exceed 0.012, 0.022, and 0.043 mg/l.

[e] The criterion for the 24-hour average in mg/l is the numerical value given by $e^{(2.35 [\ln (\text{hardness})] - 9.48)}$; the maximum concentration should not exceed the value given by $e^{(1.22 [\ln (\text{hardness})] - 0.47)}$. For example, at the above hardnesses of $CaCO_3$, the criteria are 0.00075, 0.0038, and 0.02 mg/l, respectively, as 24-hour averages, and the concentrations should not exceed 0.074, 0.17, and 4.0 mg/l, respectively.

[f] The maximum concentration should not exceed the value given by $e^{(0.53 [\ln (\text{hardness})] + 1.95)}$. For example, at the above hardnesses, the concentration should not exceed 0.18, 0.32, and 0.57 mg/l.

It is to be noted in Table V-9 that zero level is desired for some of the substances considered to be carcinogenic, but that that level may not be obtainable at this time. Some of the levels recommended in lieu of zero level cannot be measured with today's instrumentation.

The state values given are examples taken from the regulations of states having numerical standards for these constituents. Colorado was the only state surveyed which has adopted the very low level of mercury for aquatic life.

The metals listed in Table V-9 were selected for this presentation because the geothermal literature indicates their presence in the hydrothermal resource in some areas in varying amounts. It is not anticipated, however, that they will be present in all geothermal fluids in sufficient quantity to cause violation of water quality standards.

The full toxic list contains many substances, such as manmade pesticides, which were not presented in Table V-9 since they are not relevant to this discussion. However, a number of naturally-occurring organic substances in the hydrocarbon family were also not included although some of them may be found in the geopressured resource along with methane. It is felt that too little is known on this subject today to make further discussion here worthwhile.

It will also be noted in Table V-9 that only three broad use classifications are given -- i.e., freshwater aquatic life, saltwater aquatic life, and human health. EPA's Federal Register publication relates these classifications to the typical state classifications enumerated above as follows:

- Public water supplies -- The drinking water exposure component of the human health effects criteria can apply directly to this use classification or may be appropriately modified depending on whether the specific water supply is regulated by the Safe Drinking Water Act and the type and level of treatment imposed upon the supply before delivery to the consumer.
- Recreation -- The human health effects may be used to support this designated use where "fishing" is included in the state's definition of recreation. In this situation, only the portion of the criterion based on fish consumption should be used.
- Fish and other aquatic life -- The criteria based on toxicity to freshwater and saltwater aquatic life may be used directly to support this designated use.
- Agricultural and industrial uses -- The human health and aquatic life criteria are sufficiently stringent to protect these uses, although the states may develop specific criteria for these purposes.

Radioactivity, which appeared as a parameter in earlier Federal criteria, was dropped in the 1976 "Red Book" version. In addition, there are no current criteria for aluminum, fluoride, lithium, molybdenum, or vanadium, all of which have been found in geothermal deposits in this country. EPA recommends, however, that these parameters be considered in state water quality standards.

In many cases, criteria are descriptive rather than numerical. These general provisions applicable to all waters are found in all state water quality standards. They prohibit:

- toxic chemicals in concentrations found to be of public health significance or to adversely affect the use for which waters are classified
- substances which taint edible fish or impart tastes or odors to drinking water supplies
- floating or submerged matter
- excess nutrients which cause slime growths or other nuisance aquatic growths
- visible concentrations of oil, sludge deposits, scum, or foam
- objectionable turbidity.

There are several other provisions which are common to nearly all state water pollution regulations. These include a paragraph which states that notwithstanding the water quality standards contained therein, where a higher standard can be achieved, it is to be attained by the best practicable treatment and/or control of wastewaters. Another paragraph, which originated as model legislation at the Federal level, is the antidegradation requirement that waters whose quality exceeds the standards will be maintained at their existing high quality. This concept is, of course, consistent which the stated objective of P.L. 92-500, as amended -- i.e., "to restore and maintain (emphasis added) the chemical, physical, and biological integrity of the Nation's waters." Sometimes this provision is qualified by the statement that such change may be permitted if demonstrated to the state agency and EPA to be justifiable as a result of necessary economic or social development.

Another common provision is the establishment in the discharge permit of mixing zones -- or as Washington state terms it, a dilution zone -- where the water quality standards do not apply, sometimes with the exception of those relating to aesthetic values. The standards usually limit the size of the zone over the cross-sectional area of the receiving water so that there is an adequate zone of passage for swimming fish and floating organisms.

In addition to the metals shown in Table V-9, there are Federal criteria for beryllium, boron, hydrogen sulfide, iron, manganese, nickel, nitrate nitrogen, dissolved solids and salinity, and total dissolved gases. The states which have addressed these parameters are identified in Table V-10. Alkalinity and hardness, which are also subject to Federal criteria,

TABLE V-10. NUMERICAL WATER QUALITY STANDARDS
(S - applies statewide; D - applies only to designated waters)

Water Quality Standards	Alaska	Arizona	California*	Colorado	Hawaii	Idaho	Louisiana	Montana	Nevada	New Mexico	Oregon	Texas	Utah	Washington	Wyoming
Ammonia		D		D	D	D				D			D		D
Arsenic		D	S	D		D		D	S		S		D		
Barium		D	S	D		D			S		S		D		
Boron		D		D					S		S		D		
Cadmium		D	S	D		D		D	S		S		D		
Chloride				D			D		D	D		D			
Chromium (hex.)		D	S	D		D			S		S		D		
Conductivity										D					
Copper		D		D				D			S		D		
DO	S	D		D	D	D	D	D	D	D	D	D	D	D	D
Fluoride				D		D			S		S		D		
Hydrogen Sulfide		D		D									D		
Iron				D				D	D		D		D		
Lead		D	S	D		D		D	S		D		D		
Manganese		D		D							S				
Mercury		D	S	D		D		D	D				D		
Nickel				D											
Nitrate			S	D	D	D				D			D		
pH	S	D		D	D	D	D	D	S	D	D	D	S	D	S
Phosphorus					D				D	D					
Radioactivity	S	S		S		S		D	S	S	S		D		S
Selenium		D	S	D		D			S				D		
Silver		D		D		D			S				D		
Sulfate				D			D			D		D			
Total Dissolved Gas	D					D					S		D	S	D
Total Dissolved Solids	D	D[1]		2	D		D		D	D	D	D	D		
Toxic Materials	D	S						D	D	D					S[3]
Uranyl Ion							D								S
Zinc		D		D				D	S		S		D		

[1] Only for Colorado River Basin.

[2] Numerical limits are those of the Water Quality Standards of Salinity Adopted by the Colorado River Basin Salinity Control Program.

[3] Numerical limits are those in the latest edition of the Quality Criteria for Water.

* With the exceptions shown here, California's water quality standards are imposed at the regional level.

were omitted from the table since none of the states surveyed imposes water quality standards on these characteristics.

The regulations for 15 states are listed in Table V-11 along with the statutes they implement. The agencies which administer them are identified in Table V-2.

Fecal coliform criteria are omitted from the summaries since this form of pollution is not anticipated from the processes of geothermal development. However, since some state regulations require sanitary facilities on site, operators in those areas would be required to treat the sewage to meet the fecal coliform standards.

STATE WATER QUALITY REQUIREMENTS

Alaska

Title 18, Chapter 70, Water Quality Standards--Alaska Administrative Code--
These standards were adopted by the Department of Environmental Conservation pursuant to Title 46, Alaska Statutes, Water, Air, and Environmental Conservation. They are also implemented by the Department.

The fresh water use classifications established are as follows:

- WATER SUPPLY
    - drinking, culinary, and food processing
    - agriculture, including irrigation and stock watering
    - aquaculture
    - industrial
- WATER RECREATION
    - contact recreation (swimming, diving, wading, water skiing, and surfing)
    - secondary recreation (sports in which contact in the water is either incidental or accidental)
- GROWTH AND PROPAGATION OF FISH, SHELLFISH, OTHER AQUATIC LIFE, AND WILDLIFE INCLUDING WATERFOWL AND FURBEARERS

The classifications for marine uses differ in that drinking, culinary, food processing, and agriculture are dropped under water supply and seafood processing is added, and a fourth major category, harvesting for Consumption of Raw Mollusks, is designated.

Whether or not Alaska has established numerical water quality standards for various parameters applicable to all or part of these use classification is indicated in Table V-8. It is to be noted that while separate standards are not indicated for various metals and other substances listed in Table V-8, numerical standards for many of them are indirectly applied through the standard for toxic and other exotic organics and inorganic substances by reference to the limitations of the Alaska Drinking Water Standards, EPA's Quality Criteria for Water, and related documents.

TABLE V-11. STATE STATUTES AND REGULATIONS
Water Pollution Control

State	Statute	Regulation
Alaska	Title 46, Chapter 3, Laws of Alaska Water, Air, and Environmental Conservation	Title 18, Chapter 70, Alaska Administrative Code, Water Quality Standards, and Chapter 72, Wastewater Disposal
Arizona	Title 36, Chapter 16, Arizona Revised Statutes, Water Pollution Control Law	Water Quality Standards for Surface Waters; Water Quality Standards for salinity including numeric criteria and plan of implementation for salinity control, Colorado River System, and a supplement*
California	Porter-Cologne Water Quality Control Act (Division 7, Water Code) and Related Code Sections	Titles 17 and 23, California Administrative Code
Colorado	Title 25, Article 8, CRS 1973 Colorado Water Quality Control Act	Water Quality Standards and Stream Classification
		Regulations for the State Discharge Permit
		Standards for the Quality of Water Supplied to the Public
Hawaii	Chapter 342, Hawaii Revised Statutes	Water Pollution Control Regulations, Public Health Regulations Chapters 37 and 37A
Idaho	Title 39, Chapter 36, Idaho Code	Water Quality Standards and Wastewater Treatment Requirements
Louisiana	Title 30, Chapter II, Louisiana Revised Statutes	Regulation Requiring Submission for Reports for the Discharge of Industrial Waste and for the Construction or Alteration of Treatment Works; Water Quality Criteria

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* This also applies in other states through which the Colorado River flows.

(Continued)

TABLE V-11. Continued

Louisiana--Continued

		Rules Governing Disposal of Waste Oil, Oil Field Brine, and All Other Materials Resulting from the Drilling for, Production of, or Transportation of Oil, Gas or Sulfur
		Water Quality Criteria
Montana	Title 75, Chapter 5, Montana Code Annotated	Pollutant Discharge Elimination System, and Water Quality Standards MAC 16-2. 14(10)-SI4460
Nevada	Title 40, Nevada Revised Statutes, Water Pollution Control Law	Water Pollution Control Rules
New Mexico	Chapter 190, Laws of 1967, Water Quality Control Act	Water Quality Standards for Interstate and Intrastate Streams in New Mexico
Oregon	Oregon Environmental Laws, Revised Statutes Chapter 468	Regulations Relating to Water Quality Control in Oregon, Chapter 340, Oregon Administrative Rules
Texas	Title 2, Texas Codes Annotated, Texas Water Code	Water Quality Standards
Utah	Title 73, Chapter 14, Utah Code Annotated 1953, as amended, Water Pollution Control Act	Water Quality Standards, Code of Waste Disposal Regulations, Dept. of Health, Part II
Washington	Water Pollution Control, Chapter 90.48, RCW	Water Quality Standards, Chapter 173-201, WAC
Wyoming	Enrolled Act No. 107, 42nd Session, Enviromental Quality Act	Quality Standards for Wyoming Surface Water

The temperature limits are as follows:

- 15°C (59°F) maximum applicable to water supply for drinking, culinary, and food processing
- 20°C (68°F) maximum applicable to water supply for agriculture and growth and population of fish, shellfish, etc.
- 25°C (77°F) maximum applicable to industrial water supply
- 30°C (86°F) maximum applicable to water supply for agriculture and contact recreation
- Lower maximum temperatures are applied to specific areas within these use classifications. 15°C (59°F), migration water; 13°C (55°F), spawning areas; 15°C (59°F), egg and fry; 13°C (55°F), incubation

Under Chapter 72, the Department may require more stringent treatment than the minimum prescribed in Chapter 70 or prohibit the discharge of treated wastewater to sensitive environments. A waste disposal permit is required for sludge disposal, and the Department may require that industrial treatment systems be designed or operated to accept and treat sludges. A provision of specific interest in geothermal development is one which requires that designs for treatment works in remote areas be proven in comparable environmental situations. Such systems must also be designed to operate successfully under seasonal or perennial frost conditions if such conditions are to be encountered in the proposed area of construction.

Arizona

Water Quality Standards for Surface Waters--

These standards were adopted by the State Water Quality Control Council and are administered by the Department of Health Services pursuant to Title 36, Chapter 16, Arizona Revised Statutes. They have been revised since the initial survey was conducted to establish separate numerical limitations for several beneficial uses in line with the concept of the Federal water quality criteria and the practice of other states.

The state's waters are in turn classified according to beneficial use. In addition, a classification, called "effluent dominated water," has been established to include surface water segments which consist primarily of discharges of pollutants for more than 75 percent of a typical hydrological year and in which the Department has determined that one or more of the allowable pollutant limits for uses associated with that water body are not attainable through reasonable effort to treat those discharges. The major difference in the standards applicable to such waters and those which apply to other classified waters is a considerably lower dissolved oxygen level than is allowed elsewhere--1.0 mg/l as apposed to 6.0 mg/l.

The numerical Arizona standards for domestic water sources are as follows:

Substance	Limiting Concentration (mg/1)
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium (hexavalent)	0.05
Copper	1.0
Lead	0.05
Mercury	0.002
Phenol	0.001
Selenium	0.01
Silver	0.05
Zinc	5.0

It can be seen that it is too early for these standards to reflect the very low values established for some of these metals in the new Federal criteria for toxic pollutants. The same is true for all other state standards reviewed.

There is a general standard applicable to all surface waters in Arizona that requires radioactive materials attributable to or influenced by the activities of man 1) to be maintained as low as practicable considering the state of technology and the economics of improvements in relation to benefits to the public health; 2) not exceed the Arizona Radiation Regulatory Agency limits for ionizing radiation; 3) to be below the amounts which could cause harmful accumulation in plants, animals, aquatic life, or humans; and 4) not exceed a combined gross alpha and gross beta particle activity concentration of 30 picocuries per liter when the identity and concentration of the radionuclides are unknown. The other provisions of this standard deal with the NRC - controlled radioactive substances with which this report is not concerned.

The temperature standards require that the ambient water temperature not be raised by a discharge or combination of discharges by more than 3°C(5.4°F) for recreational waters and 1.0° C(1.8°F) for cold water fisheries. There are no temperature standards for waters classified for other uses.

California

Porter-Cologne Water Quality Control Act, Division 7, Water Quality

This act establishes the authority of the state to regulate all activities and factors which may affect the quality of the state's waters. It places the responsibility for administering the statewide water quality control program in the hands of nine regional water quality control boards. The State Water Resources Control Board, however, holds the primary adjudicatory and regulatory functions of the state in the field of water resources under Division 1 of the State Water Code. It formulates state policy for water quality control and establishes procedures under which the regional boards develop and implement water quality control plans, and is the state's water pollution control agency as defined by the Federal Clean Water Act, and, as such, implements the NPDES permit system within the state. This function is also carried out by the regional boards. The state board and each regional board are the principal state agencies with primary responsibility for the coordination and control of water quality, including subsurface injection and protection of underground sources of drinking water.

Neither the Act nor rulings of the state or regional boards precludes cities and counties from adopting and enforcing more stringent regulations or to prohibit nuisances.

The regional water quality control plans designate: (1) beneficial uses to be protected; (2) water quality objectives; and (3) programs of implementation needed for achieving water quality objectives. It is recognized in the Act that it may be possible to change the quality of water to some degree without unreasonably affecting beneficial uses. On the other hand, a water quality control plan or waste discharge requirements may specify certain conditions or areas where the discharge of waste, or certain types of wastes, will not be permitted. The water quality control plans, which are approved by the State Control Board, are binding on the activities of all state agencies.

The State Board may adopt water quality plans for water for which water quality standards are required by the Federal Clean Water Act which supersede regional plans if there is conflict between them.

Title 17, Public Health, California Administrative Code and Regional Water Quality Control Plan Reports--

The Regional Water Quality Control Boards in California adopt Water Quality Control Plans and the reports on these plans contain water quality standards which are applicable regionwide and others which apply only to specified waters. However, the basin limiting concentrations applied for chemical constituents in public water supplies are those set forth in Title 17, Chapter 5, of the Administrative Code. This is the codification of the public health laws.

The Regional Boards are empowered to set more stringent standards and they do so for some bodies of water. For example, the Central Valley Regional Board set separate inorganic chemical limits for portions of the Sacramento River, the American River, and Folson Lake which permit in some cases only a tenth of the concentration permitted by Title 17. The Boards also may set standards for parameters which do not appear in Title 17. The Central Valley Regional Board, for example, added copper, iron, manganese, silver, and zinc to the special standards for the above rivers and lake.

The state limitations are as follows:

Substance	Limiting Concentration (mg/l)
Arsenic	0.10
Barium	1.0
Cadmium	0.01

Substance	Limiting Concentration (mg/l)
Chromium	0.05
Cyanide	0.2
Lead	0.05
Mercury	0.005
Nitrate-N + Nitrite-N	10.0
Selenium	0.01

It may be noted that the arsenic and mercury standards are twice as permissive as the Federal criteria.

The standards set by the Colorado River Basin Region for all surface receiving waters in the West Colorado River Basin are shown in Table V-12 for illustration. The maximum arsenic concentration of 0.06 mg/l compares with a level of 0.01 mg/l in the special standards set by the Central Valley Regional Board for the waters listed above. The barium concentrations are 0.55 mg/l and 0.1 mg/l respectively, and copper, 0.06 and 0.01.

Some of the regional standards limit the concentration of boron in waters used for agricultural purposes to 0.50 mg/l.

Since the numerical limitations vary from region to region and from one reach of a river or portion of a lake to another within the regions and the standards are subject to continuing modification, no attempt has been made here to document all of them for the state. The State Board reports that the standards change so frequently that it does not keep a record of them.

TABLE V-12. LIMITING CONCENTRATIONS OF CHEMICALS IN DISCHARGES OF WASTES TO SURFACE WATERS IN THE WEST COLORADO RIVER BASIN IN CALIFORNIA

Constituent	Limiting Concentration (mg/l)*	
	90th Percentile	Maximum
Aluminum (Al)	0.10	0.11
Arsenic (As)	0.05	0.06
Barium (Ba)	0.50	0.55
Cadmium (Cd)	0.01	0.01
Chromium (Total Cr)	0.05	0.06
Copper (Cu)	0.05	0.06
Cyanide (CN)	0.005	0.01
Iron (Fe)	0.20	0.22
Lead (Pb)	0.05	0.06
Manganese (Mn)	0.05	0.06
Selenium (Se)	0.01	0.01
Silver (Ag)	0.01	0.01
Zinc (Zn)	0.05	0.06
Mercury (Hg)	0.005	0.01

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* Where natural levels already meet or exceed these levels no further increases from controlled sources are allowed.

California Administrative Code, Title 23, Subchapter 9 Waste Discharge Reports and Requirements--

This subchapter has recently been considerably amended and simplified by comparison with the version included as Appendix I in the initial survey. Most of the detail on the formulation of waste discharge requirements and other features has been repealed insofar as point source discharges are concerned. One paragraph (2235.2) simply states that waste discharge requirements for discharges from point sources to navigable waters shall be issued and administered in accordance with currently applicable Federal NPDES regulations. Filing fees and monitoring requirements are considerably reduced for dischargers who discharge less than 50,000 gallons per day of cooling water, water well start-up water, or other water which contains only insignificant amounts of pollutants and no toxic materials. This provision is favorable to those desiring to use geothermal waters for small, individual direct applications.

New provisions were added to the subchapter to regulate discharges from other than point sources. However, the definition of point source is sufficiently inclusive to indicate that the effluent from almost any currently envisioned use of geothermal resources would be deemed to be generated from a point source except the return flows from irrigated agriculture.

Time schedules are to be attached to the permit in which any discharges which are not in full compliance with the permit conditions must be brought into compliance.

Colorado

Water Quality Standards and Stream Classification--

The Colorado Water Quality Control Commission in the Department of Health both adopted and administers these regulations. They were promulgated pursuant to the Colorado Water Quality Control Act, Title 25, Article 8, Colorado Revised Statutes 1973. The water quality standards summarized in Table V-13 are excerpted from the regulations. The table is shown in full (except for pesticides) since it presents as complete a list of parameters in as concise a form as could be found.

Hawaii

Chapter 37, Public Health Regulations, Water Pollution Control, and Chapter 37-A, Water Quality Standards--

These regulations were adopted pursuant to Chapter 342, Hawaii Revised Statutes, and are administered by the Department of Health. The important provision in Chapter 37 is that prior to promulgation of applicable effluent limitations and standards NPDES permits will be subject to such conditions as the Department determines are necessary to carry out the provisions of the Federal Clean Water Act.

As might be expected in an island state, the waters of Hawaii are very narrowly defined. Inland waters are divided into nine categories--streams, springs and seeps, natural lakes, reservoirs, elevated wetlands, low wet-

TABLE V-13. COLORADO WATER QUALITY STANDARDS

PHYSICAL AND BIOLOGICAL PARAMETERS

PARAMETER	RECREATIONAL		AQUATIC LIFE			AGRICULTURE	DOMESTIC WATER SUPPLY	
	CLASS 1 Primary Contact	CLASS 2 Secondary Contact	CLASS 1 Cold Water Biota	CLASS 1 Warm Water Biota	CLASS 2		CLASS 1	CLASS 2
PHYSICAL:					To be established on a case-by-case basis.			
D.O. (mg/l)$^{(1)}$	Aerobic$^{(2)}$(A)	Aerobic$^{(2)}$(A)	6.0(3)(G) 7.0-Spawn	5.0(a)		Aerobic$^{(2)}$(A)	Aerobic$^{(2)}$(A)	Aerobic$^{(2)}$(A)
pH (Std. Units)	6.5-9.0(B^{m})		6.5-9.0(A)	6.5-9.0(A)			5.0-9.0(A)	5.0-9.0(A)
Suspended Solids (mg/l)	(4)	(4)	(4)	(4)		(4)		(4)
& Turbidity (TU)							1.0 TU(E)	
Temperature (^{0}C)			Max 20^{0} C w/3^{0}C increase (G)$^{(5)}$	Max 30^{0} C w/3^{0} C increase (G)$^{(5)}$				
BIOLOGICAL:								
Fecal Coliforms per 100 ml (Geometric mean)	200(A)$^{(6)}$	2000(G^{m}) $^{(6)}$					0(7)(E)	2000(e)

(1) Where dissolved oxygen levels less than these levels occur naturally, a discharge shall not cause a further reduction in dissolved oxygen in receiving water.

(2) An effluent shall be regulated to maintain aerobic conditions, and a guideline of 2.0 mg/liter dissolved oxygen in an effluent should be maintained, unless demonstrated otherwise.

(3) A 7 mg/liter standard, during periods of spawning of cold water fish, shall be set on a case-by-case basis as defined in the NPDES permit for those dischargers whose effluent would affect fish spawning.

(4) Suspended solid levels will be controlled by Effluent Limitation Regulations, Basic Standards, and Best Management Practices (BMP's)

(5) Temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life. Generally, a maximum 3^{0}C increase over a minimum of a four-hour period, lasting for 12 hours maximum, is deemed acceptable for discharges fluctuating in volume or temperature. Where temperature increases cannot be maintained within this range using BMP, BATEA, and BPWTT control measures, the Division will determine whether the resulting temperature increases preclude an aquatic life classification.

(6) Fecal coliform is an indicator only. It may indicate the presence of pathogenic organisms; however, fecal coliform counts from agriculture or urban runoff may not indicate organisms detrimental to human health.

(7) For drinking water with or without disinfection.

TABLE V-13. Continued

INORGANIC PARAMETERS

PARAMETER	RECREATIONAL		AQUATIC LIFE			AGRICULTURE	DOMESTIC WATER SUPPLY	
	CLASS 1 Primary Contact	CLASS 2 Secondary Contact	CLASS 1 Cold Water Biota	CLASS 1 Warm Water Biota	CLASS 2		CLASS 1	CLASS 2
INORGANICS:					To be establisned on a case-by-case basis.			
Ammonia (mg/l as N)			0.02 unionized(A)	0.06 unionized (G)			$0.5^{(1)}$(B)	$0.5^{(1)}$(B)
- Total residual Chlorine (mg/l)			0.003(H)	0.003(H)				
Cyanide - Free (mg/l)			0.005(H)	0.005(H)		0.2(G)	0.2(B,D^m)	0.2(B,D^m)
Fluoride (mg/l)							$^{(2)}$(E)	$^{(2)}$(E)
Nitrate (mg/l as N)						$100^{(3)}$(B)	10(A,B)	10(A,B)
Nitrite (mg/l as N)			0.05(G)	0.5(G)		$10^{(3)}$(B)	$1.0^{(1)}$(B)	$1.0^{(1)}$(B)
Sulfide as H_2S(mg/l)			0.002 undissociated (A)	0.002 undissociated (A)			0.05(F)	0.05(F)
Boron (mg/l)						0.75(A,B)		
Chloride (mg/l)							250(F)	250(F)
Sulfate (mg/l)							250(F)	250(F)

(1) To be applied at the point of water supply intake.

(2) Fluoride levels vary from 2.4 mg/liter at 12.0° C and below, to 1.4 mg/liter between 26.3° C and 32.5° C, based upon the annual average of the maximum daily air temperature (see National Interim Primary Drinking Water Regulations for specific limitations or any modification thereto).

(3) In order to provide a reasonable margin of safety to allow for unusual situations such as extremely high water ingestion or nitrite formation in slurries, the NO_3-N plus NO_2-N content in drinking waters for livestock and poultry should be limited to 100 ppm or less, and the NO_2-N content alone be limited to 10 ppm or less.

TABLE V-13. Continued

METAL PARAMETERS

PARAMETER	RECREATIONAL		AQUATIC LIFE							AGRI	DOMESTIC WATER SUPPLY	
	Class 1 Primary Contact	Class 2 Secondary Contact	CLASS 1						CLASS 2		CLASS 1	CLASS 2
			Cold Water and Warm Water Biota					OR Bioassay				
			Water Hardness or Alkalinity (mg/l)					(Application factor or other) (2)				
TOTAL METALS - Total conc. in mg/l			0 to 100	100 to 200	200 to 300	300 to 400	400 plus					
Aluminum(soluble)			0.1(C)	0.1(C)	0.1(C)	0.1(C)	0.1(C)	Bioassay				
Arsenic			0.05(C)	0.05(C)	0.05(C)	0.05(C)	0.05(C)	Bioassay	To be established on a Case-by-Case Basis	0.1(A)	0.05(F)	0.05(F)
Barium											1.0(F)	1.0(F)
Beryllium			0.01(A)	0.3(C)	0.6(C)	0.9(C)	1.1(A)	Bioassay		0.1(A,B)		
Cadmium			0.004(A,C,H)	0.001(A,C,H)	0.005(C,H)	0.010(C,H)	0.015(C,H)	Bioassay		0.01(B)	0.010(F)	0.010(F)
Chromium-Trivalent			0.1(H)	0.1(H)	0.1(H)	0.1(H)	0.1(H)			0.1(B)	0.05(F)	0.05(F)
Chromium-Hexavalent			0.025(H)	0.025(H)	0.025(H)	0.025(H)	0.025(H)			0.1(B)	0.05(F)	0.05(F)
Copper			0.015(C)	0.01(C)	0.01(C)	0.02(C)	0.04(C)	0.1AF(A)		0.2(B)	1.0(F)	1.0(F)
Iron			1.0(A,C)	1.0(A,C)	1.0(A,C)	1.0(A,C)	1.0(A,C)				0.3(sol)(F)	0.3(sol)(F)
Lead			0.004(C,H)	0.025(C,H)	0.050(C,H)	0.100(C,H)	0.150(C,H)	Bioassay (3)		0.1(B)	0.05(F)	0.05(F)
Manganese			1.0(C)	1.0(C)	1.0(C)	1.0(C)	1.0(C)	Bioassay		0.2(B)	0.05(sol)(F)	0.05(sol)(F)
Mercury			0.00005(A)	0.00005(A)	0.00005(A)	0.00005(A)	0.00005(A)				0.002(F)	0.002(F)
Nickel			0.05(C)	0.10(C)	0.20(C)	0.30(C)	0.40(C)	0.01AF(A)		0.2(B)		
Selenium			0.05(C,H)	0.05(C,H)	0.05(C,H)	0.05(C,H)	0.05(C,H)	0.001AF(H)		0.02(B,D)	0.01(F)	0.01(F)
Silver			0.00010(C,H)	0.00010(C,H)	0.00015(C,H)	0.00020(C,H)	0.00025(C,H)	0.01AF(A)			0.05(F)	0.05(F)
Thallium			0.015(C)	0.015(C)	0.015(C)	0.015(C)	0.015(C)	Bioassay				
Uranium			0.01(C)	0.2(C)	0.4(C)	0.8(C)	1.4(C)	Bioassay				
Zinc			0.05(C,H)	0.05(C,H)	0.10(C,H)	0.30(C,H)	0.60(C,H)	0.01AF(A)		2.0(B)	5.0(F)	5.0(F)

(1) Concentrations of total alkalinity or other chelating agents attributable to municipal, industrial or other discharges or agricultural practices should not alter the total alkalinity or other chelating agents of the receiving water by more than 20%. Where the complexing capacity of the receiving water is altered by more than 20% or where chelating agents are released to the receiving water which are not naturally characteristic of that water, specific effluent limitations for pertinent parameters shall be established. In no case shall instream modification or alteration of total alkalinity or other chelating agents be permitted without Commission authorization.

(2) Where required, bioassay procedures may be used to establish standards for a particular situation.

(3) For bioassay, lead concentration is based on soluble lead measurements; i.e., non-filterable lead using a 0.45 micron filter.

lands, coastal wetlands, anchialine pools, and estuaries -- and streams are further subcategorized as perennial and intermittent. The standards for marine waters -- open coastal waters and oceanic waters -- are applied on a site-specific basis.

Water quality standards for temperature and toxic, corrosive, or radioactive substances for all waters require, as a minimum, evaluation by use of a phytoplankton bioassay test or a 96-hour bioassay or both. Survival of test organisms shall not be less than that in controls which utilize appropriate experimental water. Field monitoring may be required to insure conformance with this standard. In most waters, salinity changes in excess of 10 percent of ambient conditions is prohibited, although this is modified somewhat for marine waters in that the percentage variation is from natural or seasonal changes considering hydrologic input and oceanographic factors. In all waters temperature variation is limited to 1°C(1.8°F) from ambient conditions.

Other numerical standards, applied with variation to all waters, appear designed primarily to control eutrophication. Those for Kjeldahl nitrogen are very low.

Idaho

Water Quality Standards and Wastewater Treatment Requirements--

These standards and regulations were adopted pursuant to Title 39, Chapter 36, Idaho Code, by the Board of Health and Welfare. They are administered by the Idaho Department of Health and Welfare.

The most unusual feature of the Idaho water quality standards for warm and cold water biota and salmonid spawning waters is the very severe limits on the concentration of un-ionized ammonia, during spawning and incubation periods in cold waters. While some geothermal fluids are known to contain ammonia, the percentage in the un-ionized state would depend on the pH of the fluid. The accompanying requirement for pH is the range of 6.5 - 9.0. At 9.0, 60 percent of the ammonia present would be ionized, and 40 percent would be un-ionized. As the pH goes lower, the balance would shift the other way.

Louisiana

Water Quality Criteria--

The Louisiana Environmental Control Commission is responsible for promulgating regulations in its area of jurisdiction which are implemented by the Office of Environmental Affairs. These water quality criteria were adopted pursuant to Title 30, Chapter II, of the Louisiana Revised Statutes. They are designated primarily to preserve existing water quality as it relates to suitability for various uses. In several instances, where existing technology permits, provisions have been made for upgrading water quality.

It is the policy of the state that all state waters will be protected for recreational uses and for the preservation and propagation of desirable species of aquatic biota. Use and value of water for public water supplies, agricultural, industrial, and other purposes were considered in setting the water quality standards, but in no case are the criteria supporting these uses to be permitted to interfere with recreational use and preservation of desirable biota. The only exception is those waters which are unsuited for these uses because of naturally - occurring poor quality, man-made pollution, or technological limitations. In the last instance, the exception is considered temporary until technology permits upgrading, and man-made pollution is considered as a problem to be solved, not as an impediment against the use of the waters for recreation and desirable biota.

For all uses, toxic substances may not exceed the TLM$_{96/10}$. Where the stream is to be used as a public water supply the level of toxic substances may not exceed the levels of the latest edition of the U.S. Public Health Service drinking water standards. It is assumed that this nomenclature would now be interpreted to mean the National Drinking Water Standards (9). No substantial increase in turbidity from ambient conditions due to waste discharges is permitted.

The general pH criterion is a range of 6.0 to 9.0, although this varies for classified waters. No discharge of wastes is to cause the pH of the water body to vary by more than one pH unit within the pH range specific to a classified water. Criteria for chlorides, sulfates, and dissolved solids levels also vary from one classified water to another, but the values in general represent the arithmetic mean of existing data plus one standard deviation.

The temperature standard consists of two parts -- a temperature differential which represents the maximum permissible rise above ambient conditions and a maximum temperature. No addition of artificial heat is permitted once the ambient temperature reaches the latter. The standards are as follows:

Fresh Water - Temperature differential

(1) Maximum of 2.8°C (5°F) rise above ambient for streams and rivers.

(2) Maximum of 1.7°C (3°F) rise above ambient for lakes and reservoirs.

MAXIMUM TEMPERATURE - 32.2°C (90°F) except where otherwise specified for specific waters or due to natural conditions.

Estuarine and Coastal Waters - Temperature differential

(1) Maximum of 2.2°C (4°F) rise above ambient during the period October through May.

(2) Maximum 0.83°C (1.5°F) during the period June through September.

MAXIMUM TEMPERATURE - 35°C (95°F) except when natural conditions elevate temperature above this level.

Montana

Water Quality Standards (MAC 16-2.14(10)-S14480)--

The Board of Health and Environmental Sciences adopted these regulations pursuant to Title 75, Chapter 5, Montana Code Annotated, Water Pollution Control Law, and they are administered by the Department of Environmental Sciences. The water quality criteria for the highest classification of waters are the ultimate in limitations since they prohibit any change in pH or any increase in turbidity, temperature, sediment, toxic substances, or radioactivity and do not apply a dissolved oxygen criterion. These waters are described as suitable for drinking, culinary, and food processing after simple disinfection, and public access and activities such as livestock grazing and timber harvest are to be controlled under conditions prescribed by the Department.

In the second classification -- for the same uses as above plus nearly all other uses including swimming with removal of naturally present impurities added to disinfection -- the criteria are somewhat less stringent. Dissolved oxygen concentration is not to be reduced below 7.0 mg/1; induced variation in pH within the range of 6.5 to 8.5 is to be less than 0.5 pH unit; and natural pH outside this range is to be maintained without change and pH above 7.0 is to be maintained above 7.0. No increase in natural turbidity is allowed and permissible temperature increases are 0.5°F to 1.0°F, depending on initial water temperature. No sediment increase which adversely affects the use is permitted. Concentrations of toxic substances, which, after treatment for domestic use, will exceed the federal drinking water regulations are prohibited (9). In any case, maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

The criteria for less demanding uses follow the usual pattern of gradually decreasing stringency. The standards also introduce a limitation on color which for some waters is two units above natural color and for other is five units.

The general criterion of most concern to geothermal operations is one which requires that industrial waste in the absence of Federal effluent limitations guidelines receive a minimum of secondary treatment or equivalent. Except in industrial operations generating effluents which require biological treatment, this requirement would not appear to apply to geothermal wastewaters. Yet it is stated as a requirement without qualification.

The Montana regulations also contain very detailed criteria on radiation which apply to all waters except the closed classification described above. They are as follows:

"The average dissolved concentrations (including the naturally occurring or background contribution) of iodine 131, radium-226, strontium-89, strontium-90, and tritium are not to exceed the following concentration limits:

Iodine-131	5 pCi/L
Radium-226	1 pCi/L
Strontium-89	100 pCi/L
Strontium-90	10 pCi/L
Tritium	3,000 pCi/L

"For all other radionuclides, the average dissolved concentration limits are to be 1/150 of the corresponding maximum permissible concentration in water for continuous occupational exposure as recommended by the National Committee on Radiation Protection (National Bureau of Standards Handbook 69 or subsequent revisions.)

"For a mixture of radionuclides, the following relationship is to be satisfied:

$$\frac{C_1}{L_1} + \frac{C_2}{L_2} \quad . \; . \; . + \frac{C_n}{L_m} \qquad \leq 1.00$$

C denotes the average concentration of the respective radionuclide, and L denotes its concentration limit.

"Where alpha emitters, strontium-90, radium-228, iodine-129, iodine-130, and lead-210 are known to be absent, routine analyses for dissolved gross beta radioactivity (excluding potassium-40 contribution) may be employed to monitor and show compliance with this criterion (except for tritium) as long as the gross concentration does not exceed 100 pCi/L. When these conditions are not met, routine quantitative analyses of individual radionuclides are to be performed to show compliance. Except in cases where tritium from other than natural sources is known to be absent, routine tritium analyses are to be performed to show compliance. (Note: "Absence" means a negligibly small fraction of the specific concentration limit, where the limit for unidentified alpha emitters is taken as the limit for radium-226).

"For radionuclides associated with suspended material in transport, the average concentration limits are to be 1/150 of the corresponding maximum permissible concentration in water (insoluble form) for continuous occupational exposure as recommended by the National Committee on Radiation Protection. In-stream sedimentation of these materials is not to produce solids beds that are not in compliance with the above requirements because of leaching and/or excessive accumulation in native flora and fauna.

"Average concentrations are to be computed from monitoring data acquired during the previous 12 months; maximum concentrations are not to exceed three times the average concentration limits specified."

The regulations go on to state that variances from concentration limits specified will be permitted if the contributing source is non-controllable or a natural source. Either criterion could conceivably be applied to geothermal waters or steam although how this will be interpreted is not clear at this time. It is possible, too, that the standards may have little or no effect on geothermal operations because there may be no associated problem of radioactivity.

Nevada

Water Pollution Control Rules--

These regulations were adopted by the State Environmental Commission pursuant to the Water Pollution Control Law, Nevada Revised Statutes, Title 40, and are administered by the Department of Environmental Protection. They prohibit the discharge of industrial wastes containing arsenic, barium, boron, cadmium, chromium, cyanide, fluoride, lead, selenium, silver, copper, and zinc which are "reasonably amenable" to treatment or control without treatment. In addition, the concentrations of these constituents for most water uses must be consistent with the limits of the 1962 Drinking Water Standards. Again it is assumed that the National Drinking Water Standards (8) are the currently accepted reference. However, in the highest classification of waters, Class A, all industrial and toxic wastes are prohibited altogether. Temperature increases above natural receiving water temperature are prohibited in Class A and B. The allowable increase is 3°C (5.4°F) in Class C, and there is no limit for Class D. Total dissolved solids are not to exceed 500 mg/l in all classifications or one-third above that characteristic of normal conditions, whichever is lesser.

The pH range for Classes A, B, and C is 6.5 to 8.5 and 6.0 to 9 for Class D which includes waters in a highly altered watershed which receive a multiplicity of discharges. The minimum dissolved oxygen levels are 6.0 mg/l for Class A, 6.0 for trout waters, and 5.0 mg/l for non-trout waters in Classes B and C, and 3.0 mg/l in Class D.

New Mexico

Water Quality Standards for Interstate and Intrastate Streams--

These standards were adopted by the Water Quality Control Commission pursuant to the New Mexico Water Quality Act (Chapter 190, Laws of 1967, as amended).

In addition to prohibiting toxic substances in detrimental concentrations, these regulations require determination of toxicities of substances in receiving water by bioassays or other acceptable means for the particular form of aquatic life to be preserved. Concentrations of toxic materials are not to exceed five percent of the 96-hour median tolerance limit except that substances which bioconcentrate are not to be present in concentrations which result in their magnification. Public water supplies are to be protected from hazardous substances which exceed the Federal drinking water standards.

The radioactivity of surface waters is to be maintained at the lowest practical level and in no case is to exceed the standards set forth in Part 4 of the New Mexico Environmental Improvement Board Radiation Protection Regulations adopted 16 June 1973.

Surface waters must be free of nitrogen and other dissolved gases at levels above 110 percent saturation when this level is due to industrial discharges.

Separate sets of standards are set forth for all waterways or reaches of waterways in the state and vary, of course, according to designated uses. The stream use designation and standards are shown for the Rio Grande Basin in Appendix I. These illustrate very clearly the range in the degree of restriction. For example, in the Elephant Butte Reservoir, at mean monthly flows above 100 cfs, the standards for the following parameters are:

TDS shall be less than 1500 mg/l
Sulfate shall be less than 500 mg/l
Chloride shall be less than 250 mg/l

The standards for the same parameters in one reach of the main stem of the Rio Grande are 500, 150, and 25 mg/l respectively. Required dissolved oxygen levels are generally greater than 5 mg/l, but 4 mg/l is acceptable in some cases. Turbidity limits range from 10 to 50 FTU. (This unit of measurement -- Formazin Turbidity Unit -- is not comparable to the Jackson Turbidity Unit (JTU) but the values are not greatly different.) Conductivity in at least one instance is limited to less than 300 umhos.

This example was not selected because there is or may be geothermal activity in the Rio Grande Basin. It is merely a good illustration of the way New Mexico has handled its water quality standards and the typical numerical ranges. This revision of the standards as they appeared in the initial version of this survey also exemplifies the fact that establishment of water quality criteria and standards is an on-going process as more scientific knowledge of the various parameters and their effects is attained. Section 303(c)(1) of the Clean Water Act requires that state standards be reviewed every three years and in New Mexico this has resulted in changes in maximum pollutant concentrations, added parameters, and redrawing of areas of standard applicability.

Oregon

Regulations Relating to Water Quality Control in Oregon (Oregon Administrative Rules, Chapter 340)--

The Environmental Quality Commission of Oregon adopts the water quality regulations which are implemented by the Department of Environmental Quality. The Oregon Water Pollution Control Laws, Revised Statutes, Chapter 468, are the statutory authority.

Separate sets of water quality standards are applied to 19 drainage basins in the state. All of them include a provision that prohibits the liberation of dissolved gases such as hydrogen sulfide in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses of surface waters.

The standards are also nearly uniform on the maximum permitted concentrations of several dissolved chemical substances. They are as follows:

	mg/l		mg/l
arsenic	0.01	fluoride	1.0
barium	1.0	iron	0.1
boron	0.5	lead	0.05
cadmium	0.003	manganese	0.05
chromium	0.02	phenols	0.001
copper	0.005	zinc	0.01
cyanide	0.005		

The maximum levels of total dissolved solids range among the 19 standards and frequently for streams within the same basin. The range is from 100 mg/l to 750 mg/l; 500 mg/l is a common value. In the Walla Walla Basin a chloride limit of 25.0 mg/l is added, and the iron and lead values are reduced to 0.03 mg/l.

The temperature standards for fresh waters vary from stream to stream, but all are based on no measurable increase outside of an assigned mixing zone, as measured relative to a point immediately upstream from a discharge. When the stream temperature is at a specified level or greater--i.e., an 0.26°C (0.5°F) increase due to a single source discharge when receiving water temperature is 0.26°C (0.5°F) below the specified temperature or less; and a 1.1°C (2.0°F) increase due to all sources combined when stream temperature is 1.1°C (2.0°F) below the specified temperature, or less. For example, if the temperature specified for no measurable increase is 68°F, the others in the standard are 67.5°F and 66°F. No significant increase is permitted in marine and estuarine waters.

Required dissolved oxygen levels also vary, although the most common values are DO concentration of at least 90 percent of saturation at the seasonal low, and 95 percent in spawning areas during spawning, incubation, hatching, and fry stages of salmonid fishes. Others range from 5.0 mg/l to 7.0 mg/l.

The Oregon standards give special recognition in the temperature and turbidity requirements to emergencies and the need to accommodate essential dredging, construction, and other legitimate activities. In the case of turbidity increases, a special permit is needed which requires application of all practiable control techniques. If a temporary exception to the temperature standards will, after application of preventative techniques, in all probability adversely affect the beneficial uses of the water, a hearing must be held.

The water quality standards may be suspended in their entirety except those relating to aesthetic conditions within a defined immediate mixing zone of specified and appropriately limited size adjacent to or surrounding the point of wastewater discharge. Such a mixing zone must be defined in the discharge permit.

Texas

Water Quality Standards--

These standards were adopted by the Texas Water Quality Board, now the Water Development Board, pursuant to Title 2, Texas Codes Annotated, the Texas

Water Code. They are administered by the Department of Water Resources. They tabulate numerical standards for all of the state's waters. The only aspect of either the pH or DO standards which is particularly noteworthy is that 4.0 mg/l is acceptable DO for a large number of areas, 5.0 is the common criteria, and in at least one area 3.0 is the value. These are more permissive numbers than those which generally prevail on the west coast. In addition, diurnal variations of 1.0 mg/l below the standard specified in the tables are permitted for not more than eight hours in any 24-hour period.

The sulfate standards range from 30 mg/l to 4500 mg/l; many range between 60-500 mg/l. The chloride standards range all the way from 40 mg/l to 30,000 mg/l. A great many are in the the 100 - 200 mg/l level, but those in the thousands are not uncommon. The very high limitations appear to be based on local conditions -- e.g., 23,000 mg/l in the Salt Fork of the Brazos River -- and they do not apply in the several coastal basins as might be expected. There are no chloride limitations applicable to bay and gulf waters.

There are no standards set on salinity in estuarine waters. However, note is made that the state proposes to adopt salinity criteria for these areas, using both existing data and data yet to be collected, upon which future regulatory actions may be based. This could be an important action to coastal geothermal operations.

The maximum temperature difference permitted in fresh water streams is 2.8°C (5.0°F) rise over ambient and 1.7°C (3.0°F) for fresh water impoundments. In tidal river reaches, bays, and gulf waters, the maximum permitted temperature difference is 2.2°C (4.0°F) in fall, winter, and spring, and 0.83°C (1.5°F) in summer.

In the general criteria, applicable to all waters of the state at all times, radioactive discharges in excess of the amount regulated under the Texas Radiation Control Act are prohibited. This provision is followed by a discussion of a study of the radioactivity levels in the surface waters of Texas, including suspended and dissolved solids, which identifies the locations where natural radioactive deposits have influenced surface water radioactivity. The standard then provides that radioactivity in fresh waters associated with dissolved minerals shall not exceed the U.S. Public Health Service Drinking Water Standards unless such conditions are of natural origin. The study was conducted by the Environmental Sanitation Services Section of the Texas Department of Health. Its report is entitled "Report on Radioactivity - Levels in Surface Waters - 1958-1960."

In public drinking water supplies, toxic materials not removed by ordinary treatment technologies are not to exceed the Drinking Water Standards. With respect to fish toxicity, in waters outside mixing zones concentrations of nonpersistent toxic materials should not exceed 1/10 of the 96-hour TLm; for persistent toxicants, the level is 1/20 of the 96-hour TLm. "Persistent" and "nonpersistent" are not defined.

Utah

Water Quality Standards (Wastewater Disposal Regulations, Utah State Division of Health, Part II)--

These regulations, pursuant to the state's Water Pollution Control Act, Title 73, Chapter 14, Utah Code Annotated, were adopted and are administered by the Committee for Water Pollution, in the Utah State Division of Health. Standards are set for six major classifications of waters and some subcategories. In addition, wastes discharged to waters of a given classification must be capable of meeting all downstream classifications.

An earlier version of the standards provided "that no waste of any kind shall be discharged from controlled areas until subjected to at least secondary treatment." A state spokesman interpreted "controlled areas" as fenced or limited access areas such as a wastewater treatment plant or lagoon. Secondary treatment was defined as a maximum discharge concentration of 25 mg/l of both BOD and settleable solids. This standard was very similar to the Montana one discussed above which does not take into account effluents that have no BOD load and do not need biological treatment, such as those from geothermal power plants and heating systems. Thus, it will be beneficial to such operations that the Utah regulation has been amended to require only the degree of treatment necessary to protect the legitimate uses of such waters.

Washington

Water Quality Standards, Washington Administrative Code, Chapter 173-201--

These standards were adopted by the Water Pollution Control Commission pursuant to Chapter 90.48 RCW, Water Pollution Control, and are implemented by the Department of Ecology. Five classes of waters are established for the purpose of applying water quality criteria. They are: Class AA, Extraordinary; Class A, Excellent; Class B, Good; Class C, Fair; and the Lake Class. Characteristic uses to be practiced in each classification are itemized and the waters of the state are classified.

The general characteristic called for in Class AA is that water quality shall markedly and uniformly exceed the requirements for all or substantially all uses. The wording ranges downward in stringency to water quality that meets or exceeds the requirement of selected and essential uses in Class C.

Dissolved oxygen standards range from in excess of 9.5 mg/l for fresh water and 7.0 mg/l for marine water in Class AA to 5.0 and 4.0 respectively in Class C. Induced temperature increases (°F) from one source are based on equations and in the case of Class AA waters may not exceed $t=75/(T-22)$ (freshwater) or $t=24/(T-39)$ (marine water); "t" represents the permissible increase and "T" represents the water temperature due to all causes combined. pH variations are limited to less than 0.1 units in Class AA, 0.25 units in Class A, 0.5 in Class B, and 0.5 units in Class C.

In lakes, no change is permitted to be made in dissolved oxygen levels, temperature, or pH. Turbidity in excess of 5 JTU over natural conditions is prohibited in Class AA, A, and lakes, and 10 JTU is the limit in Class B and C. In all classes, the concentration of total dissolved gas is not to exceed 110 percent of saturation at any point of sample collection.

Wyoming

Quality Standards for Wyoming Surface Waters--

These regulations were promulgated and are administered by the Department of Environmental Quality under the authority of Enrolled Act No. 107, 42nd Session.

The most interesting aspect of these regulations is that they reference the latest edition of EPA's Quality Criteria for Water as representing the numerical limitations on most toxic pollutants. Upon inquiry, a Department spokesman said that "latest edition" does not include the criteria for toxic pollutants discussed above.

Dissolved oxygen standards range from a minimum content of 6 mg/l in Class I waters to no induced reduction in fish spawning areas. Allowable temperature alterations range from 1.1°C (2°F) in cold water fisheries to 2.2°C (4°F) in warm water fisheries. Wastes are not permitted which will cause the pH to be less than 6.5 or greater than 8.5.

SOLID WASTE REGULATIONS

In the initial version of this survey, the discussion of state solid waste regulations followed the format established for air and water pollution control regulations, and each state's requirements were discussed separately. At this juncture, a similar presentation would not be useful since the states are currently in the process of revamping their programs in response to the two major thrusts of the Resource Conservation and Recovery Act.

These thrusts are 1) the phase-out of all open dumps for disposal of any variety of wastes, and 2) the management of hazardous wastes from the point of their generation to their disposal or treatment to a non-hazardous state. Some states had been moving in these directions even before passage of RCRA, but, to some extent, development of state programs to conform with these RCRA requirements is necessitating a major overhaul of state policy and legislative/regulatory direction, especially for hazardous wastes.

The states will be allowed more freedom in implementing the portions of RCRA dealing with non-hazardous solid wastes and can establish more stringent requirements than set forth in EPA guidelines (40 CFR Part 256, Federal Register, 31 July 1979) if they choose. This is true of nearly all Federally-mandated environmental control programs. The hazardous waste management program requirements imposed upon the states who elect to manage their own programs are virtually the only exception in that these programs must be "consistent" with the Federal program and programs of other states. The reasons for this are rooted in controversy among states over interstate shipment of hazardous wastes for treatment or disposal. On the other hand, the disposal of non-hazardous municipal wastes is considered at all levels of government to be essentially a local matter.

The latter programs will, in any event, be of no concern to potential geothermal operators beyond the disposal of extraneous trash and garbage. And, pending completion around the end of 1982 of EPA's study of the muds used in geothermal drilling and the brines produced, these substances will not be defined as hazardous wastes, as discussed in Section III.

Therefore, the interest of potential geothermal users in the state programs to implement RCRA is at present quite narrow and is limited to the wastes of specific industrial processes for which geothermal resources could supply all or part of the energy needs and/or process steam. The process wastes so classified are identified in Subpart D of 40 CFR Part 261, Federal Register, 19 May 1980, and can be generally categorized as those which contain inorganic pigments, organic solvents, pesticides, explosives, and corrosive substances. Industries producing such wastes include the metal working industries, paint and pigment manufacture and use, organic chemical and pesticide manufacture, manufacture and processing of explosives, leather tanning, the primary metals industries, and secondary lead smelting.

State programs governing the management of such wastes, or EPA's program in the absence of a state program, will impose the manifest and permit systems described in Section III. The technical standards for permitted treatment, storage, and disposal facilities are found in 40 CFR Parts 122, 260, and 264, Federal Register, 5 February 1981. Due to the costs of installing on-site facilities for treatment, storage, or disposal in conformance with these requirements, many generators of the above types of waste will employ off-site public or commercial facilities. Organic solvents are amenable to economic recovery and reuse, and the economics of recovering the very costly metals favors treatment of wastes rather than disposal.

As can be seen in Table V-14 which lists the state solid waste disposal agencies, some states have hazardous waste statutes and regulations in place, but none have yet received final EPA approval.

NOISE REGULATION

As shown in Table V-15, five of the 15 states covered by this report have noise control statutes and three have regulations in this area. The documents are summarized below.

Other states, however, undertake to control noise emanating from geothermal operations in their special regulations governing geothermal development. These were discussed earlier in this section and are usually only general prohibitions with no specific standards.

California

Noise Control Act, West's Ann. Cal. Health and Safety Code Section 4600 et seq. --

This law established an Office of Noise Control within the Department of Health. This agency now requires that all counties in the state include a noise element in thier general county plan.

TABLE V-14. STATE STATUTES AND REGULATIONS
Solid Waste Disposal

State	Statute	Regulation
Alaska	Laws of Alaska, Title 44, Chapter 46, Department of Environmental Conservation Laws	Alaska Administrative Code, Title 18, Chapter 60, Solid Waste Management
Arizona	A.R.S., Section 36-136.G.10	Arizona Code, Title 9, Chapter 8, Environmental Sanitation
California	Solid Waste Management and Resource Recovery Act of 1972, California Government Code, Title 7.3	California Administrative Codes, Title 14, Division 7, Solid Waste Management Board
	Hazardous Waste Control Act, California Health & Safety Code, Division 20	
	California Government Codes, Title 7.8, Solid Waste Management Act	California Administrative Code, Title 22, Division 4, Hazardous Waste Management Regulations
Colorado	Colorado Revised Statutes, Title 30, Article 20, Part 1, Solid Wastes Disposal Sites and Facilities Law	Solid Wastes Disposal Sites and Facilities
Hawaii	Hawaii Revised Statutes, Chapter 340A, Solid Waste Disposal Act	Hawaii Environmental Laws and Regulations, Volume II, Chapter 46, Solid Waste Management Control
Idaho	Idaho Solid Waste Law, Title 31, Chapter 44, Idaho Code; Chapter 104, Laws of 1970, as amended	Solid Waste Management Regulations and Standards
Louisiana	Louisiana Revised Statutes, Title 30, Chapter II, Solid Waste Management and Resource Recovery Law	Chapter X, Sanitary Codes, Sections 10.50-10.56.4, Solid Waste Regulations

Continued

TABLE V-14. Continued

State	Statute	Regulation
Louisiana (continued)	Louisiana Revised Statutes, Title 30, Chapter 2, Hazardous Waste Control Law	Louisiana Hazardous Waste Management Plan, Department of Natural Resources Rules and Regulations
Montana	Refuse Disposal Districts Law, Title 69, Chapter 40 RCM 1969	Refuse Disposal Regulations, Title 16, MAC, as amended
Nevada	Nevada Solid Waste Disposal Law, Nevada Revised Statutes 444.440-444-630	Regulations Governing Solid Waste Management, Department of Natural Resources
New Mexico	New Mexico Hazardous Waste Act, Chapter 313	Solid Waste Management Regulations
Oregon	Oregon Revised Statutes, Chapter 459, Solid Waste Control	Chapter 340, Division 61, Oregon Administrative Rules, Solid Waste Management
		Chapter 340, Division 63, Oregon Administrative Rules, Hazardous Waste Management
Texas	Revised Civil Statutes Annotated, Article 4477-7, Solid Waste Disposal Act	Texas Department of Health Resources Municipal Solid Waste Management Regulations
Utah	Utah Code Annotated, Title 26, Chapter 35, Solid Waste Management Act	Code of Solid Waste Regulations
	Utah Code Annotated, Title 26, Chapter 37, Hazardous Waste Management Act	
Washington	Revised Code of Washington, Title 70, Chapter 70.95, Solid Waste Management	
Wyoming	Environmental Quality Act of 1973, Article 5, Solid Waste Management	Wyoming Department of Environmental Quality Solid Waste Management Rules

TABLE V-15. STATE STATUTES AND REGULATIONS
Noise Control

State	Statute	Regulations
Alaska	None	None
Arizona	None	None
California	Noise Control Act (West's Ann. Cal. Health and Safety Code Sec. 46000 et seq.	Noise control elements in county general plans
Colorado	Title 25, Article 12, Noise Abatement	No state regulations. Some adopted at local level
Hawaii	Environmental Laws and Regulations. Vol. 1, Part IV	Community Noise Control for Oahu, Public Health Regulations, Chapter 4413
Idaho	None	None
Louisiana	None	None
Montana	None	None
Nevada	None	None
New Mexico	None	None
Oregon	Oregon Environmental Laws, Chapter 467	Noise Control Regulations, Chapter 340, Oregon Administrative Rules
Texas	None	None
Utah	None	None
Washington	Noise Control Act of 1974, Chapter 70, 107 RCW	Maximum Environmental Noise Levels, Chapter 173-60, WAC
Wyoming	None	None

Colorado

Title 25, Article 12, Noise Abatement --

This statute first prohibits noise which is objectionable because of intermittence, beat frequency, or shrillness. It then declares that sound levels at a distance of 8 m (25 ft) or more from a property line in excess of the following are prima facie evidence that the noise is a public nuisance:

Zone	7:00 am to next 7:00 pm dB(A)	7:00 pm to next 7:00 am dB(A)
Residential	55	50
Commercial	60	55
Light Industrial	70	65
Industrial	80	75

In the daytime, these noise levels may be increased by 10 dB(A) for a 15-minute period in any hour. Periodic, implusive, or shrill noises are to be considered a public nuisance when they are 5 dB(A) less than those shown above.

Hawaii

Community Noise Control for Oahu, Public Health Regulations, Chapter 44B --

These regulations, promulgated and administered by the Department of Health, prohibit "excessive" noise at or beyond property lines. Allowable noise levels at the property line are as follows:

Zoning Districts	Daytime 7 am to 10 pm dB(A)	Nightime 10 pm to 7 am dB(A)
Residential	55	45
Preservation	55	45
Apartment	60	50
Hotel	60	50
Business	60	50
Agricultural	70	70
Industrial	70	70

"Excessive noise" means any sound or sequence of sounds which exceeds these levels more than 10 percent of the time in any 20-minute period. An exception is that the allowable noise level for implusive noise is 10 dB(A) above the levels in the table. Impulsive noise is defined as any sound with a rapid rise and decay of sound pressure level, lasting less than one second, caused by sudden contact between two or more surfaces or by a sudden release of pressure. On-site vehicles or construction equipment which requires an exhaust of gas or air must be muffled.

The Director of the Department of Health may grant permits to operate equipment which emits noise in excess of the above limits under certain conditions such as when the activities are temporary and cannot be delayed to a time period in which they would be permitted. There are the following limitations on permits for construction activities, however:

1. No permit shall be granted for construction activities creating excessive noise when measured at or beyond the property line for the hours before 7:00 am and after 6:00 pm of the same day.
2. Construction activities which emit noise in excess of 95 dB(A) at or beyond the property line of the construction site shall be restricted to the hours between 9:00 am and 5:30 pm of the same day.
3. Construction activities which exceed the allowable noise levels shall be prohibited on Sundays and on the following holidays: New Year's Day, President's Day, Memorial Day, Kamehameha Day, Independence Day, Labor Day, Discoverer's Day, Veteran's Day, Thanksgiving Day, and Christmas Day. Activities exceeding 95 dB(a) shall be prohibited on Saturdays.

These regulations presently apply to Oahu only but it can be expected that activities which would create excessive noise in the more pristine islands would be subjected very quickly to similar requirements.

Oregon

Noise Control Regulations (Chapter 340, Oregon Administrative Rules Compilation --

Noise control in Oregon was authorized by Chapter 46 of its Environmental Laws. The above regulations limit noise levels generated by new industrial noise sources to the following levels:

Allowable Statistical Noise Levels in Any One Hour

7 am - 10 pm	10 pm - 7 am
L_{50} - 55 dB(A)	L_{50} - 50 dB(A)
L_{10} - 60 dB(A)	L_{10} - 55 dB(A)
L_1 - 75 dB(A)	L_1 - 60 dB(A)

"Statistical Noise Level" means the noise level which is equalled or is exceeded a stated percentage of the time. An L_{10} - 65 dB(A) implies that in any hour of the day 65 dB(A) can be equalled or exceeded only 10 percent of the time, or for six minutes.

Notwithstanding the allowable levels in the table, a new industrial noise source may not be operated on property previously unoccupied by an industrial source if the noise levels generated will increase the ambient statistical noise levels, L_{10} or L_{50}, in any one hour by more than 10 dB(A) as measured at an appropriate point.

"Quiet Areas" may be established in wilderness areas, national and state parks, game reserves, or similar areas where the following limitations will apply:

7 am - 10 pm	10 pm - 7 am
L_{50} - 50 dB(A)	L_{50} - 45 dB(A)
L_{10} - 55 dB(A)	L_{10} - 50 dB(A)
L_{1} - 60 dB(A)	L_{1} - 55 dB(A)

Notwithstanding the above rules, the operation of an industrial noise source which emits an impulse sound in the air, as measured at the appropriate point, which has a peak sound pressure level in excess of 100 dB during the hours 7 am to 10 pm and 80 dB between the hours 10 pm and 7 am is prohibited. "Impulse sound" is defined as either a single pressure peak or a simple burst (multiple pressure peaks) for a duration of less than one second as measured on a peak unweighted sound pressure measuring instrument.

When the Department of Environmental Quality believes that the levels in the above tables do not adequately protect the public health, safety, or welfare, the Department may prohibit the operation of a noise source if the operation generates octave bands sound pressure levels which exceed the following:

Allowable Octave Band Sound Pressure Levels

Octave Band Center Frequency, Hz	7 am - 10 pm	10 pm - 7 am
31.5	68	65
63	65	62
125	61	56
250	55	50
500	52	46
1000	49	43
2000	46	40
4000	43	37
8000	40	34

The regulations go on to set still further highly technical alternative restrictions which may be imposed under cetain conditions.

The "appropriate measurement point" means one of two points on the noise-sensitive property, whichever is further from the noise source -- i.e., 8 m (25 ft) toward the noise source from that point on the noise-sensitive building nearest the noise source, or the point on the noise-sensitive property line nearest the noise source.

Measurement methods will be prescribed and monitoring may be required.

Sounds created at construction sites are exempt.

Washington

Maximum Environmental Noise Levels Chapter 173-60 WAC --
These regulations were adopted pursuant to the state's Noise Control Act of 1974, Chapter 70, 107RWC. They establish "environmental designations for noise abatement" (EDNA), the areas or zones within which the maximum permissible noise levels are established. Typically, Class A EDNA embrace property used for human habitation (including camps, parks, etc.); Class B are lands involving uses requiring protection against noise interference with speech (hotels, restaurants, retail and commercial services, theatres, stadiums, etc.); Class C includes warehouse, industrial, agricultural, and similar areas.

The maximum permissible noise levels intruding into the property of another are as follows:

EDNA OF NOISE SOURCE	EDNA OF RECEIVING PROPERTY		
	Class A	Class B	Class C
CLASS A	55 dB(A)	57 dB(A)	60 dB(A)
CLASS B	57	60	65
CLASS C	60	65	70

These are subject to the following exceptions:

1. Between the hours of 10:00 pm and 7:00 am the noise limitations of the foregoing table shall be reduced by 10 dB(A) for receiving property within Class A EDNAs.

2. At any hour of the day or night the applicable noise limitations in (a) and (b) above may be exceeded for any receiving property by no more than:

   a. 5 dB(A) for a total of 15 minutes in any one-hour period; or
   b. 10 dB(A) for a total of 5 minutes in any one-hour period; or
   c. 15 db(A) for a total of 1.5 minutes in any one-hour period.

Sounds resulting from construction are exempt except in Class A EDNAs between 10:00 pm and 7:00 am. Such sounds are to be covered in new standards.

Nothing in the regulations precludes required installation of the best available noise abatement technology consistent with economic feasibility. Nor are local governments prohibited from preventing noise as a nuisance.

Enforcement will be undertaken only on the complaint of a person affected by the noise. Any required measurement is to be conducted with a sound level meter at any point within the receiving property.

The state encourages noise control at the local level and the Department of Ecology will not engage directly in enforcement when a local government has an approved program.

SECTION VI

COUNTY GEOTHERMAL REGULATIONS

The documents of nine counties in California and one in Oregon which undertake to regulate geothermal development within their borders are summarized below. These include Sonoma County (site of The Geysers), Napa, Imperial, Plumas, Mono, Modoc, Inyo, Lassen, and Lake Counties in California and Malheur County in Oregon. The California state geothermal statute, discussed earlier, gives the state jurisdiction as lead agency under the California Environmental Quality Act over geothermal exploratory drilling and power plant construction unless the county acts to assume this role and the State does not preempt these ordinances. CEQA is an added layer of administration, not a replacement. Imperial County is the only one so far to develop the required county plan and to assume CEQA jurisdiction.

It is understood that use permits are also required for geothermal development in Eureka, Churchill, and Washoe Counties in Nevada and Box Elder County in Utah. In addition, the City of Klamath Falls, Oregon, is developing a geothermal management ordinance to provide for the administration, finance, and regulation of geothermal activities. The reader is further referred to the permitting process of the Hawaii County Planning Department, which is reported to be quite different than those described below.

SONOMA COUNTY, CALIFORNIA

At the time of the initial survey, the Sonoma County Planning Commission was reported to be in the process of preparing a plan for the regulation of geothermal development. However, this action has never been taken, and the County, according to a Planning Department source, is still handling geothermal development through its Zoning Ordinance (Chapter 26, Sonoma County Code) and an Ordinance Adopting Procedures for Implementing the California Environmental Quality Act of 1970 (Ordinance No. 1628, as amended).

The zoning ordinance establishes various types of districts in which specific uses of land and buildings are permitted or prohibited. In most districts, certain uses are allowed without a permit and a permit is required for others. The removal of minerals is permitted in any district with the exception that no geothermal activity other than exploratory drilling or leasing may occur in the districts which are designated Exclusive Agricultural. This type of district was set aside to implement the California Land Conservation Act of 1965 to preserve land for the commercial production of agricultural commodities. A use permit is required for mineral extraction.

In addition, public utility transmission lines, both overhead and underground, are allowed in all districts without a use permit, provided the Planning Commission reviews and approves the routes. Similarly, the public roads or highways, sewer and wastewater lines and accessory facilities, water supply lines and accessory facilities, and drainage channels or pipes are permitted in all districts subject to compliance with other county regulation of such activities.

The county's environmental impact report procedures provide several ways of defining a "Private Project" as a first step in determining whether an EIR is required for the proposed activity. In line with the state EIR guidelines, these are primarily projects for which some kind of county approval -- license, certification, use permit, etc. -- is required. In this way, geothermal production is defined as a "private project" by virtue of the necessity for a use permit only in agriculture districts. The attendant activities listed above also require various state/county certifications which also place them under the EIR umbrella.

The procedures for determining the eligiblity of a project for EIR preparation are also in line with the state guidelines. The ascending order of decision-making EIR authority is the county Planning Director, Environmental Protection Committee (made up of representatives of various county departments), and the cognizant planning agency (in the case of geothermal production, the Board of Zoning Adjustment). The opportunity for public comment is provided on both negative declarations (no EIR needed) and on the draft EIRs. It is the Planning Director's responsibility to prepare the EIR or have it prepared by an outside consultant. To the contrary of requiring approval or disapproval of a project no later than a given period, action may not be taken by the Board for approximately a month after a negative declaration or EIR is filed.

NAPA COUNTY, CALIFORNIA

The Napa County Conservation, Development, and Planning Department ordinance dealing with geothermal development is entitled:

> An ordinance of the Board of Supervisors of the County of Napa, State of California, Regulating the Use of Land for Certain Exploration and Development Activities for Oil and Gas or Geothermal Resources, by Use Permit Within the County of NAPA; Providing Bonding and Insurance Requirements in Connection With Such Permit and Fees therefore.

The ordinance establishes procedures for the exploration and possible development and conservation of geothermal steam, associated geothermal resources, and/or hot water; the prevention of waste; the protection of the public interest; and the protection of air and water quality and other environmental qualities.

Use Permits

Two types of use permits are authorized. The first is for temporary exploratory holes under 150 m (500 ft) in depth which must be sealed within 90 days from the time drilling begins. The other is for a geothermal exploration or development project which involves wells deeper than 150 m (500 ft) and/or geophysical and geologic exploratory operations, construction of roads, power plants, steam or electrical transmission lines, or other appurtenant features.

The applications for both types of permits require proof that all test measurements and waste discharge programs have been submitted to and are being processed by the Regional Water Quality Board. Other provisions of both require information relating to proposed land use and land contour. The exploration and development permit application also requires a description of the noise attenuation program to be employed, including estimates of sound pressure levels, scale and frequency bands which are expected from generators, air compressors, blooie lines, clean-out, and test operations after attenuation. A tentative plan must also be filed which shows the size and location of power generation, mineral extraction, desalination, pumping stations, and other surface facilities including their relationship to known geological fault zones.

A use permit would be issued subject to the terms and conditions that the Conservation, Development, and Planning Commission feels necessary to insure adequate protection of the public interest. These may include, but are not limited to, the categories of pesticides, herbicides, water quality control, sanitation and waste disposal, land subsidence, seismic activity, aesthetics, fish and wildlife, antiquities and historical sites, and restoration. Such conditions to the project will be attached by reference to the EIR.

Denial of Permits

The bases for permit denial are so comprehensive that it is felt that they warrant full reproduction here. The Commission will be required to deny any application if it finds any of the following:

"A. Adequate mitigation measures do not exist for all forms of air, land, water and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid and gaseous wastes, protection of surface and sub-surface waters, plants, humans, fish and wildlife and their habitats.

"B. The establishment, operation and maintenance or the use of building applied for, will, under the circumstances of the particular case, be materially detrimental to the health, safety, peace, comfort, and general welfare of persons residing or working in the vicinity of the use, or the general welfare of the County will be endangered by damage to components of the ecological system such as vegetation, air, water, crops, household and agricultural water supplies from erosion increase, water quality degradation, groundwater infiltration, habitat loss, noise, dust, impact on fragile or sensitive areas, wildlife disturbance, impedance of wildlife movement, aesthetics disturbance, land use and cultural disturbance, road failures, off-site land degradation, seepage, spillage, or escape of toxic materials, liquids or drill muds, venting or spillage of biosensitive materials, unacceptable sump materials dumping sites and neutralization of biosensitive sump materials, and system-wide leakages or emissions due to breakdowns, punctures or vandalism, full or partial steam and gases vented to the atmosphere causing vegetation, crop, wildlife, aquatic organisms, domestic animals or human damage; and additional environmental changes of an air quality nature such as:

"1. Impact of potential acid rainfall and potential effect on vegetation, wildlife, aquatic organisms, human health, air chemistry, and agricultural production. Non-condensible gas status impact for carbon dioxide, methane, hydrogen, nitrogen, argon, mercury vapor, strontium, hydrogen sulfide, ammonia, ethane, radon, etc.

"2. Potential contributions to smog from photo-oxidation of hydrogen sulfide and ammonia. Probability of significant effects from dissemination of these substances as both gases and aerosols over Napa County, especially Napa, Pope, and Chiles Valley and Lake Berryessa. Evidence of effects are not known, are inconclusive or the acceptability limits are not known.

"3. Location and remote effects of increased levels of emissions from full field development arising from non-condensible gases and such other materials as boron, chlorides, heavy metals, particularly mercury, lead, copper, etc., and radioactive materials such as radon and strontium on biota of all types in relation to standards such as EPA, State Health Department, etc.

"4. Premature condensation of moisture in air preventing thunderstorms in the Sierra Nevada and local climate modification such as increased fog and ice."

Review of Permits

The ordinance authorizes review of permits after one year and thereafter at intervals of not less than 36 months. The Commission may amend or revoke the permit if it finds that the permit "adversely affects the public health, safety, peace, morals, comfort and general welfare or the conditions above under 'Denial of Permits' are not being met."

IMPERIAL COUNTY, CALIFORNIA

Imperial County has adopted a Geothermal Element to its General Plan which will permit geothermal development in areas classified as Geothermal Overlay zones and allow production activities by Conditional Use Permit containing performance standards. The plan was developed under a study grant from the National Science Foundation. The objectives of the plan are to:

1. Facilitate development of geothermal energy at feasible locations.
2. Mitigate undesirable environmental or social impacts of geothermal development.
3. Provide reasonable and effective regulation.

In addition to the plan, the project produced a document presenting research methodology and study results which is available to other areas faced with the task of assessing impacts and formulating policy to control newly-developed energy resources. The University of California at Riverside (UCR) and the California Institute of Technology performed specific task assignments under the grant, and the environmental analysis, including a study of subsidence, was conducted by UCR.

Terms, Conditions, Standards, and Application Procedures for Initial Geothermal Development

Water pollution control and solid waste disposal are handled in this document simply by stating that as a general condition all waste, whether liquid or solid, must be disposed of in compliance with existing county, state, and Federal rules and regulations. Proof that all test and waste discharge information has been filed with the Regional Water Quality Control Board must accompany a permit application. The plans for all permanent sumps, brine ponds, and waste holding pools must be based on a soils investigation. Impervious or lined pool bottoms are required.

All operations shall be conducted in compliance with the requirements of the Imperial County Air Pollution Control Office. In addition, all operators are directed to take steps to insure that no harmful or obnoxious gases are released.

The site development and land use plan are to provide for maximum surface land use including preservation of farm lands. As their participation in the Subsidence Detection Program, operators are required to install a minimum of one permanent benchmark per well as directed by the County Surveyor. The operator is to tie this benchmark into the nearest point of USGS level net by first order leveling techniques. As an additional protection against subsidence, injection of 80% of the withdrawn geothermal fluid is required.

The drilling and production standards are very specific on the regulation of noise. A graph is provided, shown here in Figure VI-1, which gives numerical limitations applicable to noise at the property boundary.

Operators adjacent to or near existing development must also conform to more stringent limitations. The graph shown in Figure VI-2 will be utilized and the planning commission will determine which curve will apply. The above 10 percent exception is also applicable.

FIGURE VI-1. NOISE LEVEL LIMITATIONS FOR ALL GEOTHERMAL OPERATIONS IN IMPERIAL COUNTY, CALIFORNIA

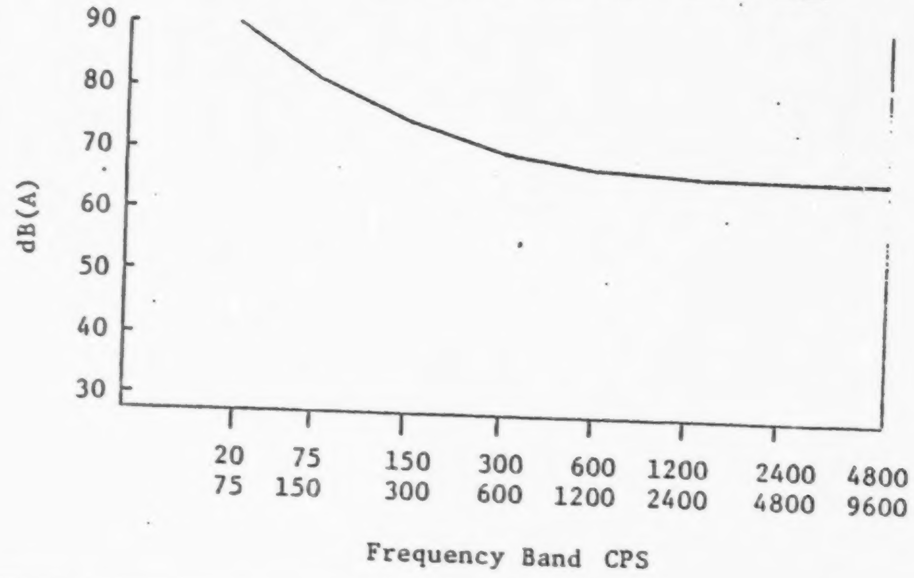
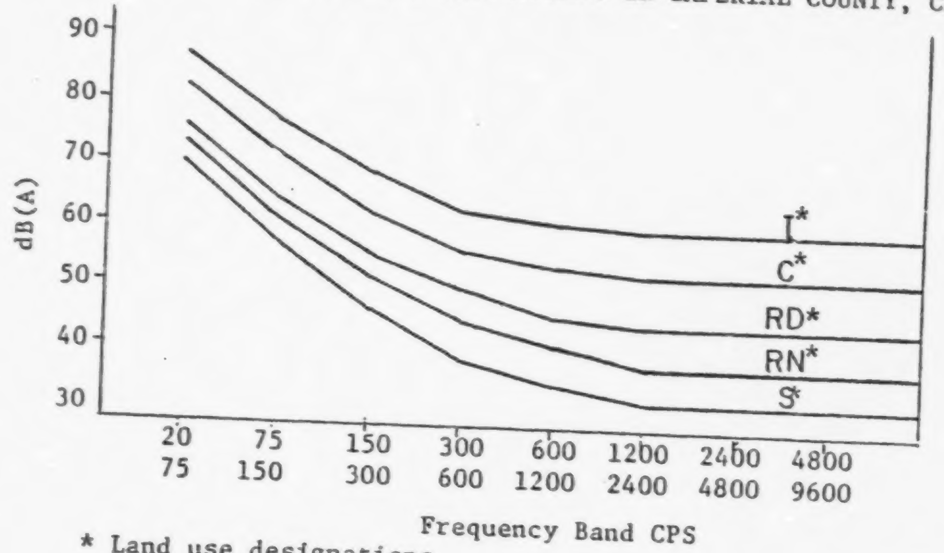


FIGURE VI-2. NOISE LEVEL LIMITATIONS FOR GEOTHERMAL OPERATIONS ADJACENT TO OR NEAR EXISTING DEVELOPMENT IN IMPERIAL COUNTY, CALIFORNIA



* Land use designations
I - industrial; C - commercial; RD - residential day;
RN - residential night; S - school area

All off-site collection pipelines are to be buried and in agricultural or potential agricultural areas, holding ponds must be purged of brine, salts removed, and the berms leveled to the satisfaction of the county. Information is required in the permit application on the relationship of surface facilities to known active faults.

PLUMAS COUNTY, CALIFORNIA

Plumas County deals with geothermal development through its zoning law. It is permitted in certain types of districts, usually subject to a Special Use Permit. Under "Uses Permitted" in each district, geothermal resources are mentioned as such only in the Exclusive Agricultural District. However, the county Planning Department indicates that geothermal activities are permitted in General Forest, General Agriculture, and Industrial Districts.

A special use permit issued in 1973 for a test geothermal well has some detailed environmentally-related provisions. One is that the permit does not commit the county to future development of the geothermal field, approval of which depends upon a review of information on the significant reservoir parameters supplied when testing is completed. This information should include the following:

a. Temperature
b. Rate of extrusion
c. Ratio of gas phase to fluid phase
d. Chemistry

1. Noncompressible gases

carbon dioxide
hydrogen sulfide
sulfur oxides
argon
oxygen
ammonia
hydrocarbons $C_1 - C_5$

2. Total dissolved solids
3. Total hardness
4. Alkalinity
5. pH
6. Other
7. Dissolved solids

bicarbonate
carbonate
hydroxide
chloride
sulfate
nitrate
fluoride, fluorine

7. Dissolved solids--Continued

- iron
- manganese
- arsenic
- boron
- mercury
- sodium
- calcium
- magnesium
- potassium
- xenon
- other

This review will require an EIR addressed to the operator's entire lease-holding which establishes where and how the operator will create future wells and install generating facilities and transmission lines. It will also consider potential hazards to public safety and welfare and magnitudes of the impacts on wildlife, agriculture, water and air quality, and scenery. There is no specific designation as to who will prepare the EIR.

The 1973 permit stated that as a means of air pollution control, if field development were permitted, a closed production system would be required if a fluid phase geothermal system were encountered or a minimum 80 percent reinjection system if a gaseous phase system were found. The permit also stated that a newly-developed closed system would be operational very soon, and an 80 percent injection system would probably be operational in two to four years.

The county also requires parallel development of agricultural use and electric power generation of any geothermal resources discovered in order to maintain its agricultural economy. This subject is to be addressed in the EIR along with the county's intention to establish, presumably on the operator's leasehold, an ecological reserve for the protection of the habitat of migrant waterfowl which would exclude geothermal operations. The county also retained the authority to suspend site operations should unforeseen effects on waterfowl be ascertained.

A permit is required from the county Air Pollution Control District prior to well extension operations and air drilling operations, if employed. No other reference is made to air pollution control.

Similarly no water quality or effluent standards are prescribed, but some specific water pollution control requirements are imposed. These include the confinement of all drilling mud, rock cuttings, and extruded fluids to steel leak-proof containers; immediate notification to the county environmental planner in the event of fluid spillage no matter what quantity; no interference with established drainage patterns and water courses, and discontinuance of operations during excessive rainfall and flood periods if health and safety hazards are indicated. In addition, the operator is directed to transport extruded geothermal fluids to the nearest Class I (secured) landfill if they are refused in Washoe County, Nevada.

Diesel mufflers are required to reduce drilling noise and the following noise-level standards are established:

a. Noise shall not exceed 65 dB(A), USA Standards Institute Criteria, at any human habitation (in this case, at the nearest ranch buildings).

b. Noise shall not exceed 90 dB(A) at the well site.

Another provision of the use permit which appears unique is that the operator is directed to furnish an accurate measurement of well-site soil shrink-swell potential and bearing capacity and to provide an engineering design for the well-site pad that describes anticipated static and dynamic loads and justifies the calculated foundation design. Pursuant to approval of the County Planning Director, the operator shall then construct such foundation (excavation and engineered backfill, engineered ballast, etc.) as indicated by the study.

MONO COUNTY, CALIFORNIA

The Mono County Department of Planning advised that with the establishment of a KGRA within its borders and the drilling of two exploratory wells in the early 1970's that it was felt necessary to establish county policy and regulations looking toward geothermal development. Since that time, however, the Department has experienced the inability to exercise any local jurisdiction. Seventy-nine percent of the land in the county is federally-owned. The county's position now is that it is without jurisdiction on public lands and that the cognizant Federal and state agencies must be responsible for their actions in these areas.

Geothermal development on private land is subject to Conditional Use Permits which are obtained on the merit of the individual application. The permits are structured to permit amendments or additions to the conditions as the need arises. It has been found that a rigid set of regulations which attempts to cover all situations throughout the county becomes so burdensome to both the applicant and the regulatory agency that it becomes unmanageable. The Department feels that this approach results in under-restrictive or over-restrictive regulations for any given situation.

MODOC COUNTY, CALIFORNIA

The Modoc County "Terms, Conditions, Standards and Application Procedures for Initial Geothermal Development" are virtually identical to those of Imperial County. The only significant differences are that: (1) data prepared by a permit applicant for submission to state and Federal agencies may be substituted for information required by Modoc County if the data adequately fill the requirements; and (2) the noise standard is much less specific in that it only prohibits noise levels that will create a nuisance to nearby residents.

INYO COUNTY, CALIFORNIA

The Geothermal Ordinance of Inyo County (Ord. 239, Section 1.20, 1973) is also very similar to the Imperial and Modoc County documents although its may be substituted for information required by Modoc County if the data adequately fill the requirements; and (2) the noise standard is much less specific in that it only prohibits noise levels that will create a nuisance to nearby residents.

INYO COUNTY, CALIFORNIA

The Geothermal Ordinance of Inyo County (Ord. 239, Section 1.20, 1973) is also very similar to the Imperial and Modoc County documents although its effects may be somewhat more restrictive. This is because certain requirements that apply only in previously developed areas in the other counties are applicable countywide in Inyo County. There is one important addition in the Inyo ordinance, however. This is a more detailed subsidence and earth movement study which requires annual measurement and reporting of information gained from benchmarks in a grid. If any subsidence or earth movement is detected, the County Surveyor will specify the measurement and report schedule.

An operator is also required to participate in a hot springs protection program. This involves mapping all known or possible hot springs and filing a report, before the first exploratory well is drilled, on the volume, rate of flow, chemical composition, temperature, and other pertinent data on the spring. Surveys of the wells are to be conducted at two-month intervals for the first two years of a conditional use permit. If no adverse effects are revealed, the survey period is extended to every six months. If adverse effects appear to be of a permanent nature, the operator will be instructed to begin a program to return the affected hot spring to its original state.

LASSEN COUNTY, CALIFORNIA

Geothermal wells are permitted in any zoning district of Lassen County with the acquisition of a conditional use permit. An applicant first submits a preliminary environmental questionnaire which provides the basis for the county decision as to whether an EIR is required. Once the EIR procedure is completed in accord with the state guidelines, the applicant files a very brief application for his conditional use permit.

LAKE COUNTY, CALIFORNIA

Lake County Conditions, Procedures, and Performance Standards

The regulation of geothermal development in Lake County is currently in a state of flux. The existing regulations, called Conditions, Procedures, and Performance Standards, have not been officially revised, but new performance standards have, in effect, been evolving through the issuance of land use permits for geothermal development. Each such permit is individually reviewed by the Planning Commission, and each on has its own set of special conditions. An example is shown in Appendix J.

The general plan for the County is currently undergoing revision, and the draft plan contains new geothermal performance standards. Due to the controversy surrounding them, it is not known at this writing whether these standards, or some modification of them, will be included in the final plan, or whether the final plan will simply recommend revising the existing Conditions, Procedures, and Performance Standards.

MALHEUR COUNTY, OREGON

These regulations are almost identical to those of Imperial County, California, incorporating the very specific noise limitations.

SECTION VII

REFERENCES

1. Beeland, G. V. 1978. Survey of Environmental Regulations Applying to Geothermal Exploration, Development, and Use. Environmental Protection Agency 600/7-78-014. Feb.

2. Interagency Geothermal Streamlining Task Force. 1979. Geothermal Streamlining Recommendations, a Report to the Interagency Geothermal Coordinating Council.

3. Smith, W. A., 1981. Letter from Union Oil Company of California.

4. Anon. 1980. Inside EPA, Weekly Report Vol. 1, No. 28.

5. Office of the Secretary. 1973. Final Environmental Statement for the Geothermal Leasing Program Department of the Interior.

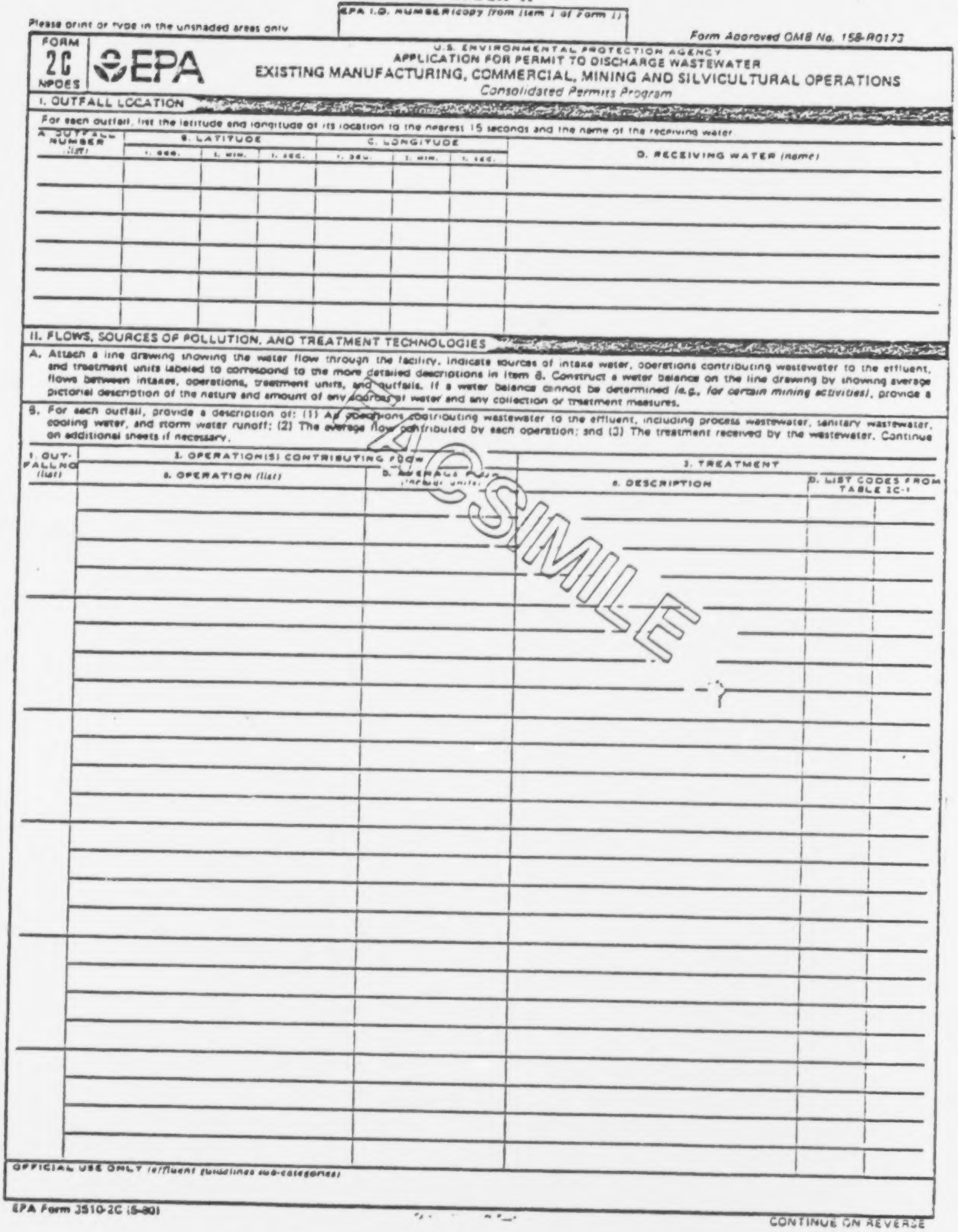
6. Anon. 1975, Geothermal Energy.

7. Linton, A. M. 1974. "Innovative Geothermal Uses in Agriculture," Proceedings of the International Conference on Geothermal Energy for Industrial, Agricultural, and Commercial-Residential Uses, Multipurpose Use of Geothermal Energy, Klamath Falls, Oregon.

8. Hagmann, E.L., Minicucci, D.D., and Wolbach, C.D. 1982. Hazardous Components of Geothermal Solid Wastes & Environmental Protection Agency, Contract No: 68-03-2567. (in press)

9. National Drinking Water Standards, 40 CFR 141, 142, and 143.

APPENDIX A



EPA I.D. NUMBER (copy from Item 1 of Form 1)

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Form Approved OMB No. 158-R0173

FORM 2C NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER *(list)*	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER *(name)*
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)*, provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUTFALL NO. *(list)*	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION *(list)*	b. AVERAGE FLOW *(include units)*	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

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C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?
☐ YES *(complete the following table)*
☐ NO *(go to Section III)*

1. OUTFALL NUMBER *(list)*	2. OPERATION(s) CONTRIBUTING FLOW *(list)*	3. FREQUENCY		4. FLOW				
		a. DAYS PER WEEK *(specify average)*	b. MONTHS PER YEAR *(specify average)*	a. FLOW RATE *(in mgd)*		b. TOTAL VOLUME *(specify with units)*		c. DURATION *(in days)*
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY	

III. MAXIMUM PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?
☐ YES *(complete Item III-B)*
☐ NO *(go to Section IV)*

B. Are the limitations in the applicable effluent guideline expressed in terms of production *(or other measure of operation)*?
☐ YES *(complete Item III-C)*
☐ NO *(go to Section IV)*

C. If you answered "Yes" to Item III-B, list the quantity which represents an actual measurement of your maximum level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. MAXIMUM QUANTITY			2. AFFECTED OUTFALLS *(list outfall numbers)*
a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. *(specify)*	

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IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.
☐ YES *(complete the following table)*
☐ NO *(go to Item IV-B)*

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE	
	a. NO.	b. SOURCE OF DISCHARGE		a. REQUIRED	b. PROJECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs *(or other environmental projects which may affect your discharges)* you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction. ☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

CONTINUE ON PAGE 3

CONTINUED FROM PAGE 2

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V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding — Complete one set of tables for each outfall — Annotate the outfall number in the space provided.
NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE

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VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

A. Is any pollutant listed in Item V-C a substance or a component of a substance which you do or expect that you will over the next 5 years use or manufacture as an intermediate or final product or byproduct?

☐ YES (list all such pollutants below) ☐ NO (go to Item VI-B)

B. Are your operations such that your raw materials, processes, or products can reasonably be expected to vary so that your discharges of pollutants may during the next 5 years exceed two times the maximum values reported in Item V?

☐ YES (complete Item VI-C below) ☐ NO (go to Section VII)

C. If you answered "Yes" to Item VI-B, explain below and describe in detail the sources and expected levels of such pollutants which you anticipate will be discharged from each outfall over the next 5 years, to the best of your ability at this time. Continue on additional sheets if you need more space.

CONTINUE ON REVERSE

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VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ YES *(identify the test(s) and describe their purposes below)*

☐ NO *(go to Section VIII)*

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VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☐ YES *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)*

☐ NO *(go to Section IX)*

A. NAME	B. ADDRESS	C. TELEPHONE *(area code & no.)*	D. POLLUTANTS ANALYZED *(list)*

IX. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*

B. PHONE NO. *(area code & no.)*

C. SIGNATURE

D. DATE SIGNED

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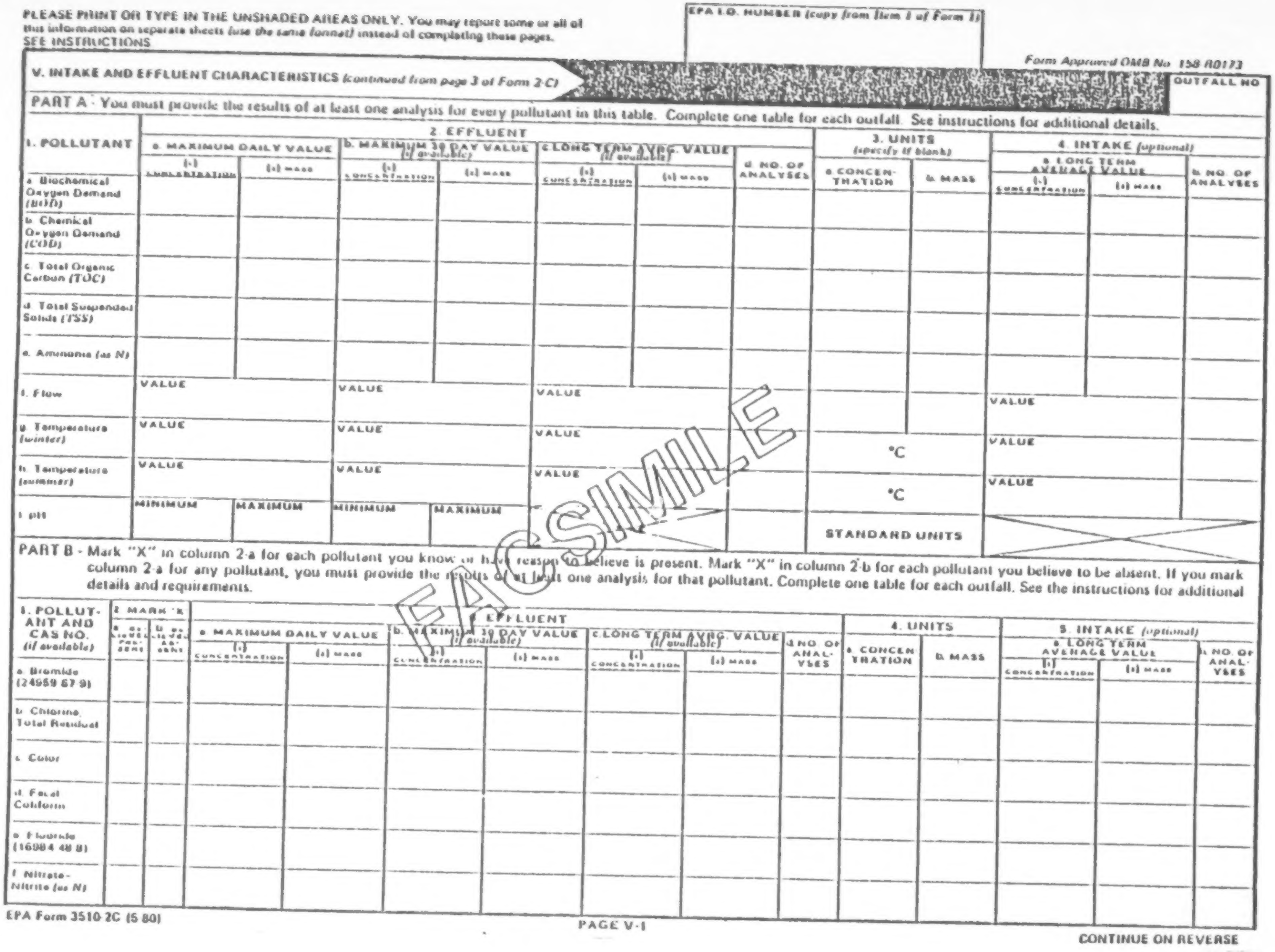

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages.
SEE INSTRUCTIONS

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*

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V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*												
e. Ammonia *(as N)*												
f. Flow	VALUE		VALUE		VALUE					VALUE		
g. Temperature *(winter)*	VALUE		VALUE		VALUE			°C		VALUE		
h. Temperature *(summer)*	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM				STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2-a for any pollutant, you must provide the results of at least one analysis for that pollutant. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUT-ANT AND CAS NO. *(if available)*	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959 67 9)														
b. Chlorine, Total Residual														
c. Color														
d. Fecal Coliform														
e. Fluoride (16984 48 8)														
f. Nitrate-Nitrite *(as N)*														

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PAGE V-1

CONTINUE ON REVERSE

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*														
h. Oil and Grease														
i. Phosphorus *(as P)*, Total (7723-14-0)														
j. Radioactivity														
(1) Alpha, Total														
(2) Beta, Total														
(3) Radium, Total														
(4) Radium 226, Total														
k. Sulfate *(as SO_4)* (14808-79-8)														
l. Sulfide *(as S)*														
m. Sulfite *(as SO_3)* (14265-45-3)														
n. Surfactants														
o. Aluminum, Total (7429-90-5)														
p. Barium, Total (7440-39-3)														
q. Boron, Total (7440-42-8)														
r. Cobalt, Total (7440-48-4)														
s. Iron, Total (7439-89-6)														
t. Magnesium, Total (7439-95-4)														
u. Molybdenum, Total (7439-98-7)														
v. Manganese, Total (7439-96-5)														
w. Tin, Total (7440-31-5)														
x. Titanium, Total (7440-32-6)														

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CONTINUE ON PAGE V-3

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER

CONTINUED FROM PAGE 3 OF FORM 2 C

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PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, non–process wastewater outfalls, and non–required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe to be absent. If you mark either columns 2-a or 2-b for any pollutant, you must provide the results of at least one analysis for that pollutant. Note that there are seven pages to this part; please review each carefully. Complete one table *(all seven pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)															
2M. Arsenic, Total (7440-38-2)															
3M. Beryllium, Total, 7440-41-7)															
4M. Cadmium, Total (7440-43-9)															
5M. Chromium, Total (7440-47-3)															
6M. Copper, Total (7550-50-8)															
7M. Lead, Total (7439-97-6)															
8M. Mercury, Total (7439-97-6)															
9M. Nickel, Total (7440-02-0)															
10M. Selenium, Total (7782-49-2)															
11M. Silver, Total (7440-22-4)															
12M. Thallium, Total (7440-28-0)															
13M. Zinc, Total (7440-66-6)															
14M. Cyanide, Total (57-12-5)															
15M. Phenols, Total															
DIOXIN															
2,3,7,8 Tetra chlorodibenzo P Dioxin (1764-01-6)				DESCRIBE RESULTS											

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CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO OF ANALYSES
				(1) concentration	(2) mass	(1) concentration	(2) mass	(1) concentration	(2) mass				(1) concentration	(2) mass	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V Acrolein (107 02 8)															
2V Acrylonitrile (107 13 1)															
3V. Benzene (71 43 2)															
4V. Bis (Chloromethyl) Ether (542 88 1)															
5V Bromoform (75 25 2)															
6V. Carbon Tetrachloride (56 23 5)															
7V Chlorobenzene (108 90 7)															
8V Chlorodibromomethane (124 48 1)															
9V Chloroethane (75 00 3)															
10V. 2 Chloroethylvinyl Ether (110 75 8)															
11V. Chloroform (67 66 3)															
12V. Dichlorobromomethane (75 27 4)															
13V. Dichlorodifluoromethane (75 71 8)															
14V 1,1 Dichloroethane (75 34 3)															
15V 1,2 Dichloroethane (107-06 2)															
16V 1,1 Dichloroethylene (75 35 4)															
17V 1,2 Dichloropropane (78 87 5)															
18V 1,2 Dichloropropylene (542 75 6)															
19V Ethylbenzene (100 41 4)															
20V Methyl Bromide (74 83 9)															
21V Methyl Chloride (74 87 3)															

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CONTINUE ON PAGE V 5

CONTINUED FROM PAGE V-4

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1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (continued)															
22V. Methylene Chloride (75-09-2)															
23V. 1,1,2,2-Tetrachloroethane (79-34-5)															
24V. Tetrachloroethylene (127-18-4)															
25V. Toluene (108-88-3)															
26V. 1,2-Trans-Dichloroethylene (156-60-5)															
27V. 1,1,1-Trichloroethane (71-55-6)															
28V. 1,1,2-Trichloroethane (79-00-5)															
29V. Trichloroethylene (79-01-6)															
30V. Trichlorofluoromethane (75-69-4)															
31V. Vinyl Chloride (75-01-4)															
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)															
2A. 2,4-Dichlorophenol (120-83-2)															
3A. 2,4-Dimethylphenol (105-67-9)															
4A. 4,6-Dinitro-O-Cresol (534-52-1)															
5A. 2,4-Dinitrophenol (51-28-5)															
6A. 2-Nitrophenol (88-75-5)															
7A. 4-Nitrophenol (100-02-7)															
8A. P-Chloro-M-Cresol (59-50-7)															
9A. Pentachlorophenol (87-86-5)															
10A. Phenol (108-95-2)															
11A. 2,4,6-Trichlorophenol (88-06-2)															

FACSIMILE

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. [illegible]	b. [illegible]	c. [illegible]	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)															
2B. Acenaphtylene (208-96-8)															
3B. Anthracene (120-12-7)															
4B. Benzidine (92-87-5)															
5B. Benzo *(a)* Anthracene (56-55-3)															
6B. Benzo *(a)* Pyrene (50-32-8)															
7B. 3,4-Benzofluoranthene (205-99-2)															
8B. Benzo *(ghi)* Perylene (191-24-2)															
9B. Benzo *(k)* Fluoranthene (207-08-9)															
10B. Bis *(2-Chloroethoxy)* Methane (111-91-1)															
11B. Bis *(2-Chloroethyl)* Ether (111-44-4)															
12B. Bis *(2-Chloroisopropyl)* Ether (39638-32-9)															
13B. Bis *(2-Ethylhexyl)* Phthalate (117-81-7)															
14B. 4-Bromophenyl Phenyl Ether (101-55-3)															
15B. Butyl Benzyl Phthalate (85-68-7)															
16B. 2-Chloronaphthalene (91-58-7)															
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)															
18B. Chrysene (218-01-9)															
19B. Dibenzo *(a,h)* Anthracene (53-70-3)															
20B. 1,2-Dichlorobenzene (95-50-1)															
21B. 1,3-Dichlorobenzene (541-73-1															

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CONTINUE ON PAGE V-7

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER

CONTINUED FROM PAGE V-6

Form Approved OMB No. 158-R0173

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. [illegible]	b. [illegible]	c. [illegible]	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS *(continued)*															
22B. 1,4-Dichlorobenzene (106-46-7)															
23B. 3,3'-Dichlorobenzidine (91-94-1)															
24B. Diethyl Phthalate (84-66-2)															
25B. Dimethyl Phthalate (131-11-3)															
26B. Di-N-Butyl Phthalate (84-74-2)															
27B. 2,4-Dinitrotoluene (121-14-2)															
28B. 2,6-Dinitrotoluene (606-20-2)															
29B. Di-N-Octyl Phthalate (117-84-0)															
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)															
31B. Fluoranthene (206-44-0)															
32B. Fluorene (86-73-7)															
33B. Hexachlorobenzene (118-74-1)															
34B. Hexachlorobutadiene (87-68-3)															
35B. Hexachlorocyclopentadiene (77-47-4)															
36B. Hexachloroethane (67-72-1)															
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)															
38B. Isophorone (78-59-1)															
39B. Naphthalene (91-20-3)															
40B. Nitrobenzene (98-95-3)															
41B. N-Nitrosodimethylamine (62-75-9)															
42B. N-Nitrosodi-N-Propylamine (621-64-7)															

FACSIMILE

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS *(continued)*															
43B. N-Nitrosodiphenylamine (86-30-6)															
44B. Phenanthrene (85-01-8)															
45B. Pyrene (129-00-0)															
46B. 1,2,4-Trichlorobenzene (120-82-1)															
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)															
2P. α-BHC (319-84-6)															
3P. β-BHC (319-85-7)															
4P. γ-BHC (58-89-9)															
5P. δ-BHC (319-86-8)															
6P. Chlordane (57-74-9)															
7P. 4,4'-DDT (50-29-3)															
8P. 4,4'-DDE (72-55-9)															
9P. 4,4'-DDD (72-54-8)															
10P. Dieldrin (60-57-1)															
11P. α-Endosulfan (115-29-7)															
12P. β-Endosulfan (115-29-7)															
13P. Endosulfan Sulfate (1031-07-8)															
14P. Endrin (72-20-8)															
15P. Endrin Aldehyde (7421-93-4)															
16P. Heptachlor (76-44-8)															

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EPA Form 3510-2C (6-80)

CONTINUE ON PAGE V-9

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER

Form Approved OMB No. 158 R0173

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES *(continued)*															
17P. Heptachlor Epoxide (1024-57-3)															
18P. PCB-1242 (53469-21-9)															
19P. PCB-1254 (11097-69-1)															
20P. PCB-1221 (11104-28-2)															
21P. PCB-1232 (11141-16-5)															
22P. PCB-1248 (12672-29-6)															
23P. PCB-1260 (11096-82-5)															
24P. PCB-1016 (12674-11-2)															
25P. Toxaphene (8001-35-2)															

EPA Form 3510-2C (5-80)

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APPENDIX B

California Regional Water Quality Control Board
North Coast Region
Order No. 73-134
WASTE DISCHARGE REQUIREMENTS

for

UNION OIL COMPANY OF CALIFORNIA
The Geysers, Sonoma County

The California Regional Water Quality Control Board, North Coast Region, finds that:

1. Union Oil Company of California is currently engaged in geothermal well drilling and exploration, transportation of steam to PG&E power plants, and disposal of waste condensate from PG&E power plants. These operations are or will be conducted on lands located in the following townships: T10N, R8W; T11N, R9W; T11N, R8W; and T12N, R9W, MDB & M. This area is within the Big Sulphur Creek drainage basin and Big Sulphur Creek is a tributary to the Russian River.

2. Wastes produced during the site preparation and during the drilling operations consist of silt, soil, rock cuttings, drilling muds with additives, oils, and associated wastewater. These wastes have traditionally been discharged to waste pits located adjacent to the drilling operations.

3. Due to the severe topography, geology, and weather conditions encountered in the Geysers area, waste pits are subject to failure and have failed and discharged waste to the waters of the State.

4. Waste condensate produced during geothermal power generation is metered and injected into the subsurface strata.

5. The Regional Board adopted Order No. 70-4 Waste Discharge Requirements for Union Oil Company of California on October 29, 1970.

6. The Regional Board adopted an Interim Water Quality Control Plan for the North Coastal Basin on June 14, 1971, and amended the Plan on December 13, 1972 and April 26, 1973.

7. Beneficial uses of waters of Big Sulphur Creek (a Russian River tributary) include:

   a. recreation
   b. preservation and enhancement of fish and wildlife
   c. aesthetic enjoyment
   d. industrial water supply

8. Beneficial uses of the Russian River waters include:

   a. domestic water supply
   b. industrial water supply
   c. agricultural water supply
   d. recreation
   e. preservation and enhancement of fish and wildlife
   f. aesthetic enjoyment

9. The Board has notified the discharger and interested agencies and persons of its intent to prescribe requirements for the proposed discharge.

10. The Board in a public meeting heard and considered all comments pertaining to the discharge.

THEREFORE, IT IS HEREBY ORDERED that Order No. 70-4 adopted October 29, 1970 be rescinded and Union Oil Company of California shall comply with the following:

A. DISCHARGE SPECIFICATIONS

1. The discharge of wastes of any nature to the waters of Big Sulphur Creek or its tributaries is prohibited.

2. The disposal of drilling muds, oils, and associated wastewater in any area not approved and classified by the Regional Board as a disposal site is prohibited.

3. Neither the treatment nor disposal of waste shall cause a nuisance or pollution.

B. PROVISIONS

1. Wastes produced during the drilling site preparation, road construction, and road maintenance shall be placed where it cannot be reasonably expected to be carried into the water of Big Sulphur Creek or its tributaries.

2. Drilling muds, oils, and associated wastewater shall only be disposed of at sites approved by the Regional Board as provided in Chapter 3, Title 23, subchapter 15, of the California Administrative Code, Waste Disposal to Land.

3. All road and exposed earth surfaces shall be protected from erosion.

4. Union Oil Company of California shall comply with the Notification, Monitoring and Reporting Program No. 73-134 and the General Provisions for Monitoring and Reporting as specified by the Executive Officer.

5. Sanitary facilities shall be provided at each drill site.

Certification

I, David C. Joseph, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, North Coast Region, on December 19, 1973.

ORIGINAL SIGNED BY

David C. Joseph
Executive Officer

APPENDIX C

California Regional Water Quality Control Board
North Coast Region

NOTIFICATION, MONITORING AND REPORTING PROGRAM NO. 73-134

for

UNION OIL COMPANY OF CALIFORNIA
The Geysers, Sonoma County

Notification

The discharger shall submit a notice in writing to the Regional Board at least 30 days prior to any construction associated with well drilling or drill site preparation, including road constuction. The notice shall include:

1. proposed construction dates
2. location of the facilities
3. description of the facilities
4. method of construction
5. proposed location of ultimate disposal of drilling muds

In addition, the discharger shall immediate notify the Regional Board of any circulation loss during the construction of a well. The notice shall include:

1. location of the well
2. depth of the well
3. amount of drilling mud lost
4. method of correction

Monitoring

1. The discharger shall record the volume of waste material removed to an approved disposal area each week and report that data to the Regional Board monthly.

2. Samples of condensate to be disposed of by injection shall be analyzed for the following constituents:

Constituents	Units	Type of Sample	Sampling and Reporting Frequency
Electrical Conductivity	micromhos.	grab	annually
Boron	mg/l	grab	annually
Sulfate	mg/l	grab	annually
Nitrate	mg/l	grab	annually
Volume	bbls/mo.	---	monthly

Reporting

In reporting the monitoring data, the discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The monitoring and any necessary narrative reports shall be transmitted in accordance with specifications of Resolution No. 71-5 adopted by this Board on February 3, 1971.

ORIGINAL SIGNED BY

Ordered by ____________________
David C. Joseph
Executive Officer

December 19, 1973

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

GENERAL MONITORING AND REPORTING PROVISIONS

February 3, 1971

GENERAL PROVISIONS FOR SAMPLING AND ANALYSIS

Unless otherwise noted, all sampling, sample preservation, and analysis shall be conducted in accordance with the current edition of "Standard Methods for the Examination of Water and Waste Water" or approved by the Executive Officer.

All analyses shall be performed in a laboratory certified to perform such analyses by the California State Department of Public Health or a laboratory approved by the Executive Officer.

All samples shall be representative of the waste discharge under the conditions of peak load.

GENERAL PROVISIONS FOR REPORTING

For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time and submit a timetable for correction.

By January 30 of each year, the discharger shall submit an annual report to the Regional Board. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the discharger shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.

The discharger shall file a written report within 90 days after the average dry weather flow for any month that equals or exceeds 75 percent of the design capacity of the waste treatment or disposal facilities. The report shall contain a schedule for studies, design, and other steps needed to provide additional capacity or limit the flow below the design capacity prior to the time when the wasteflow rate equals the capacity of the present units.

APPENDIX D

Form 3200-21
(May 1974)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

GEOTHERMAL RESOURCES LEASE

___ Competitive ___ Noncompetitive

Serial Number

USGS – KGRA Determination:

In consideration of the terms and conditions contained herein, and the grant made hereby, this lease is entered into by the UNITED STATES OF AMERICA (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and

(hereinafter called the "Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001–1025) (hereinafter called "the Act") to be effective on (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements of (a) all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, (b) all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and by reference made a part hereof, and (c) any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

Sec. 1. GRANT – The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, (hereinafter called "geothermal resources"), in or under the following described lands situated within the County of , State of .

National Resource Lands	Acquired Lands
T. ; R. ; Meridian	T. ; R. ; Meridian
Total Area	Total Area

Containing acres (hereinafter called the "leased area" or "leased lands"), together with:

(a) The nonexclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and

(b) The right to construct or erect and to use, operate, and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generating plants, transmission lines, industrial facilities, electric, telegraph or telephone lines, and such other works and structures and to use so much of the surface of the land as may be necessary or reasonably convenient for the production, utilization, and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *Provided that*, although the use of the leased area for an electric power generating plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and

(c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development are conducted in accordance with procedures approved by the Supervisor of the Geological Survey (hereinafter called "Supervisor"); and

(d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended, and supplemented (30 U.S.C. 181–287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351–359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leasable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam: *Provided that*, an application is made therefor prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The Lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21–54), which would constitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with the purposes for which these lands are administered; and

(e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the Lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

Sec. 2. TERM

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty-year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced on the leased lands or under an approved plan or agreement on behalf of the leased lands prior to the end of the primary term, and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is incapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for so long as such by-products are produced in commercial quantities but not for more than five (5) years from the date of such determination.

Sec. 3. RENTALS AND ROYALTIES

(a) *Annual Rental* – For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased lands, the Lessee shall pay the Lessor on or before the anniversary date of the lease a rental of $ for each acre or fraction thereof.

(b) *Escalating Rental* – Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional sum of one (1) dollar per acre or fraction thereof. If the lease is extended beyond ten (10) years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year. If any expenditures are made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of $ per acre or fraction thereof due the Lessor for that or any future year.

(c) *Royalty* – On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources and thereafter on a monthly basis, the Lessee shall pay to the Lessor:

(1) A royalty of percent on the amount or value of steam, or any other form of heat or other associated energy produced, processed, removed, sold, or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(2) A royalty of percent of the value of any by-product derived from production under this lease, produced, processed, removed, sold, or utilized from this lease or reasonably susceptible of sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Sec. 1 of the Mineral Leasing Act of February 25, 1920, as amended, (30 U.S.C. 131), the rate of royalty for such mineral shall be the same as that provided in that statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(3) A royalty of percent of the value of commercially demineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or is reasonably susceptible of sale or utilization by the Lessee. In no event shall the Lessee pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands or any subsequent lease year, a royalty of less than two (2) dollars per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference on or before the expiration date of the lease year for which it is paid.

(d) *Waiver and Suspension of Rental and Royalties* – Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) *Undivided Fractional Interests* – Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Sec. 1 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessor in the geothermal resources underlying such tract is to the full fee interest.

(f) *Readjustments* – Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein, and at not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

Sec. 4. PAYMENTS – It is expressly understood that the Secretary may establish the values and minimum values of geothermal resources to compute royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall cause the lease to terminate by operation of law except as provided by Sec. 3244.2 of the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

Sec. 5. BONDS – The Lessee shall file with the Authorized Officer of the Bureau (hereinafter called the "Authorized Officer") shall maintain at all times the bonds required under the regulations to be furnished as a condition to the issuance of this lease or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

Sec. 6. WELLS

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into different funds from those into which royalties under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At the Lessee's election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require so that the leased lands may be properly and timely developed and for the production of geothermal steam and its by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a program therefor is not initiated with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering or disposal system without cost to the Lessee, if the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of this option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water where required to do so by the Lessor, except when the option is being exercised and then only with respect to wells where it is being exercised, or limit the Lessor's right to take any action under Sec. 25 to enforce that requirement.

Sec. 7. INSPECTION – The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

Sec. 8. CONDUCT OF OPERATIONS – The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor to prevent bodily injury, danger to life or health, or property damage, and to avoid the waste of resources, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3204, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of this lease, including the stipulations attached hereto, will be subject to all the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

Sec. 9. INDEMNIFICATION

(a) The Lessee shall be liable to the Lessor for any damage suffered by the Lessor in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the Lessor acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the Lessor from all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Sec. 10. CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS – The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN – Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

Sec. 12. REPORTS AND OTHER INFORMATION – At such times and in such form as the Lessor may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect on the environment by operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessor may release to the general public any reports, maps, or other information submitted by the Lessee except geologic and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

Sec. 13. DILIGENT EXPLORATION – In the manner required by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the primary term the Lessee shall make at least the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS – The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to or removal of improvements owned by the United States or other parties; or (g) damage to or destruction or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time when required and to the extent deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or solid waste, and, so far as possible, repair the offsite and onsite damage caused by his activity or activities incidental thereto, and return access roads or trails and the leased lands to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe the steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

Sec. 15. WASTE – The Lessee shall use all reasonable precautions to prevent waste of natural resources and energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine zones with any oil, gas, fresh water, or other gas or water bearing formations or zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise, air, and water quality conditions in accordance with any orders of the Supervisor.

Sec. 16. MEASUREMENTS – The Lessee shall gauge or otherwise measure all production, sales, or utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. Reports on production, sales, or utilization of geothermal resources shall be submitted in accordance with the terms of this lease and the regulations.

Sec. 17. RESERVATIONS TO LESSOR – All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) *Disposal* – The right to sell or otherwise dispose of the surface of the leased lands or any resource in the leased lands under existing laws, or laws hereafter enacted, subject to the rights of the Lessee under this lease;

(b) *Rights-of-way* – The right to authorize geological and geophysical explorations on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) *Mineral Rights* – The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) *Casing* – The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations; and

(e) *Measurements* – The right to measure geothermal resources and to sample any production thereof.

Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE – The Lessee shall immediately bring to the attention of the Authorized Officer any antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Authorized Officer with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433). Prior to operations, the Lessee shall furnish to the Authorized Officer a certified statement that either no archaeological values exist or that they may exist on the leased lands to the best of the of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the Lessor or the surface owner.

Sec. 19. DIRECTIONAL DRILLING – A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the nearby land for the purposes of this lease, and production of geothermal resources from the leased area through any directional well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as granting to the Lessee any right in any land outside the leased area.

Sec. 20. OVERRIDING ROYALTIES – The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output nor in excess of 50 percent of the rate of royalty due to the Lessor specified in Sec. 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty during any period when the royalties due to the Lessor have been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS – The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

Sec. 22. COOPERATIVE OR UNIT PLAN – The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, subscribe to and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development which has been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

Sec. 23. RELINQUISHMENT OF LEASE – The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper BLM office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or any portion of the leased area shall relieve the Lessee or its surety from any liability for breach of any obligation of this lease, including the obligation to make payment of all accrued rentals and royalties and to place all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall within a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools, and materials in accordance with applicable regulations and orders of the Supervisor. However, the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed in the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other leases.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee, as provided above, which are allowed to remain on the leased lands shall become the property of the Lessor on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at its own expense, or if it fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Sec. 25. REMEDIES IN CASE OF DEFAULT

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or the terms and stipulations of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations, and that default shall continue for a period of thirty (30) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Sec. 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Sec. 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Sec. 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO Orders, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as it may deem necessary to correct the failure, including a suspension of operations or production, all at the expense of the Lessee.

(c) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occuring at any other time.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Sec. 12 of the

Act and in the regulations promulgated thereunder.

(e) Upon cancellation, the Lessee shall remove all property in accordance with Sec. 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

Sec. 26. HEIRS AND SUCCESSORS IN INTEREST – Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

Sec. 27. UNLAWFUL INTEREST – No Member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Sec. 3741 of the Revised Statutes (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

Sec. 28. MONOPOLY AND FAIR PRICES – The Lessor reserves full power and authority to protect the public interest by promulgating and enforcing all orders necessary to insure the sale of the production from the leased lands at reasonable prices, to prevent monopoly, and to safeguard the public interest.

Sec. 29. EQUAL OPPORTUNITY CLAUSE – The Lessee agrees that, during the performance of this contract:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (29) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or subcontract, or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance, *provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

Sec. 30. CERTIFICATION OF NONSEGREGATED FACILITIES – By entering into this lease, the Lessee certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, or restaurants or other eating areas, time clocks, or locker rooms, and other storage or dressing rooms, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise. Lessee further agrees that (except where it has obtained identical certifications from proposed contractors and subcontractors for specific time periods) it will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that it will retain such certifications in its files; and that it will forward the following certification to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods); it will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

Sec. 31. SPECIAL STIPULATIONS – *(stipulations, if any, are attached hereto and made a part hereof)*

In witness whereof the parties have executed this lease.

Lessee:

THE UNITED STATES OF AMERICA, Lessor:

(Signature of Lessee)

By

(Authorized Officer)

(Signature of Lessee)

(Title)

SEAL

(Date)

Date

GPO 938-471

APPENDIX E

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Notice Number

NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE EXPLORATION OPERATIONS

Applicant(s)	**Address** *(include zip code)*
Operator	**Address** *(include zip code)*
Contractor(s)	**Address** *(include zip code)*

hereby apply for authorization to conduct exploration operations pursuant to the provisions of 43 CFR 3209 now or hereafter in force across and upon the following-described lands *(give description of lands by township, attach map or maps showing lands to be entered or affected)*

Type of operations to be conducted *(give brief description)*

Exploration operations will be conducted during the period *(date)* **from** **to**

Attached ☐ **$** **Surety bond** ☐ **Rider to Nationwide bond** ☐ **Rider to Statewide bond** ☐ **Bond to be furnished**

Upon completion of exploration operations the undersigned agrees to notify the Authorized Officer that authorized exploration operations have been completed in conformance with the general and special terms and stipulations of the notice.

The undersigned hereby agrees (1) that he will not enter upon the described land until he has been informed in writing whether there are special stipulations applicable to his Notice of Intent, as to either time or method of operation or otherwise, and, if there are such stipulations, what those stipulations are, (2) that he will comply with those special stipulations, if any; and (3) that he will not enter upon the described lands until his entry has been approved by the Authorized Officer.

The undersigned agrees to be bound by the terms and conditions of this notice to conduct exploration operations when approved by the Authorized Officer.

The undersigned agrees that the filing of this ***Notice*** **under the regulations (43 CFR Subpart 3209) does not vest or confer any preference right to a geothermal resources lease.**

The undersigned agrees further that all exploration operations shall be conducted pursuant to the following terms and conditions:

1. **Exploration operations shall be conducted in compliance with all Federal, State, and local laws, ordinances, or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish, and game. All operations hereunder shall be conducted in a prudent manner.**
2. **Due care shall be exercised in protecting the described lands from damage. All necessary precautions shall be taken to avoid any damage other than normal wear and tear to improvements on the land including, but not limited to, gates, bridges, roads, culverts, cattle guards, fences, dams, dikes, vegetative cover, improvements, stock watering, and other facilities.**
3. **All drill holes shall be capped when not in use and appropriate procedures shall be taken to protect against hazards in order to protect the lives, safety, or property of other persons or of wildlife and livestock.**
4. **All vehicles shall be operated at a reasonable rate of speed and, in the operation of vehicles, due care shall be taken to safeguard livestock and wildlife in the vicinity of operations. Existing roads and trails shall be used wherever possible. If new roads and trails are to be constructed, the Authorized Officer must be consulted prior to construction as to location and specifications. Reclamation and/or reseeding of new roads and trails shall be made as requested by the Authorized Officer.**
5. **Upon expiration, conclusion, or abandonment of operations conducted pursuant to this** ***Notice*****, all equipment shall be removed from the land, and the land shall be restored as nearly as practicable to its original condition by such measures as the Authorized Officer may specify. All geophysical holes shall be safely plugged. The Authorized Officer shall be furnished a** ***Notice of Completion of Geothermal Resource Exploration Operations*** **(Form 3200-3) immediately upon cessation of all such operations and shall be further informed of the completion of reclamation work as soon as possible.**
6. **Location and depth of water sands encountered shall be disclosed to the Authorized Officer.**

(Continued on reverse)

Form 3200-9 (December 1973)

7. Operator shall contact the Authorized Officer prior to actual entry upon the land in order to be appraised of practices which shall be followed or avoided in the conduct of exploration operations pursuant to the terms of this *Notice* and applicable regulations. Operator will conduct no operations on the land unless the attached bond is in good standing.

8. Due care shall be exercised to avoid scarring or removal of ground vegetative cover.

9. All operations shall be conducted in such a manner to avoid (a) blockage of any drainage systems, (b) changing the character, or causing the pollution or siltation of rivers, streams, lakes, ponds, waterholes, seeps, and marshes; and (c) damaging fish and wildlife resources or habitat. Cuts or fills causing any of the above-mentioned problems will be repaired immediately in accordance with specifications of the Authorized Officer.

10. Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossings.

11. Surface damage which induces soil movement and/or water pollution shall be subject to corrective action as required by the Authorized Officer.

12. Trails and campsites shall be kept clean. All garbage and foreign debris shall be eliminated as required by the Authorized Officer.

13. Operator shall protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage. He shall, at his expense reestablish damaged, destroyed, or obliterated monuments and corners, using a licensed surveyor, in accordance with Federal survey procedures. A record of the reestablishment shall be submitted to the Authorized Officer.

14. Operator shall make every reasonable effort to prevent, control, or suppress any fires started by the operator, and to report, as soon as possible, to the Authorized Officer location and size of fires, and assistance needed to suppress such fires. Operator shall inform the Authorized Officer as soon as possible of all fires, regardless of location, noted, or suppressed by independent action.

15. No work shall be done within one-half mile of a developed recreation site without specific written authority from the Authorized Officer. Any travel within one-half mile of a recreation site shall be over existing roads or trails.

16. Use of explosives within one-half mile of designated waters is prohibited unless approved, in writing, by the Authorized Officer.

17. If operations conducted under the provisions of this *Notice* causes any damage to the surface of the national resource lands, such as, but not limited to, soil erosion, pollution of water, injury or destruction of livestock or wildlife, or littering, operator shall, within 48 hours, file with the Authorized Officer a map showing exact location of such damage and a written report containing operator's plans for correcting or minimizing damage, if possible.

18. Violation of, or failure to comply with any of these terms and conditions shall result in immediate shutdown of field operations until deficiency is corrected. Failure to correct deficiency within the time period allowed by the Authorized Officer shall result in forfeiture of bond.

19. The Bureau of Land Management reserves the right to close any area to operators in periods of fire danger or when irreparable damage to natural resources is imminent.

20. Contractor shall be liable for assuring compliance with all terms and conditions of this *Notice* and all actions of his designated operator, agents, and employees.

21. Where continuation of the operation will result in irreparable damage to the land and other natural resources this *Notice* will be immediately cancelled by the Authorized Officer.

22. Special Stipulations:

(Signature of Applicant) (Date) (Signature of Operator) (Date)

We hereby agree to the special stipulations added and made a part of this *Notice* to conduct exploration operations.

(Signature of Holder of Notice) (Date) (Signature of Operator) (Date)

I hereby approve this *Notice* to conduct exploration operations.

(Signature of Authorized Officer) (Title) (Date)

GPO 881-317

APPENDIX F

Subsidence Requirements of
State of Wyoming Geothermal Lease

SECTION 11. SUBSIDENCE. The Board reserves and retains the right, upon receipt of any evidence of subsidence of the surface of either the leased or adjacent lands, to determine that any or all further operations under this lease would or might aggravate or cause subsidence to the impairment of, or interference with, the developed areas adjacent to the leased lands or damage to other properties. In the event of such determination, the Board may notify the Lessee, in writing, to suspend in the manner and to the extent specified in said notice, all or any part of Lessee's operations under this lease within thirty (30) days of said notice, and Lessee agrees to suspend said operations within said time in the manner and to the extent so specified. The Lessee must also notify the Board immediately of any evidence of subsidence.

Exercise of the foregoing right by the Board is subject to the following PROVISOS:

(a) Such determination may be made by the Board at any time during the effective term of this lease but only at a meeting of said Board after written notice to Lessee that the Board has received evidence of such subsidence and proposes to determine whether any or all further operations under this lease would or might cause or aggravate subsidence to the impairment of, or interference with, the developed area or damage to other properties adjacent to the leased lands. At any such meeting Lessee may present facts and arguments relevant to such determination.

(b) At said meeting, the Board shall, to the best of its ability and to the extent permitted by law, make available to Lessee for study any and all written and graphic information and opinions theretofore recieved or prepared by or for the Board relative to susidence of the surface of the leased and adjacent lands.

(c) Operations under this lease suspended pursuant to this Section may be resumed by lessee, in whole or in part, only in the manner and to the extent provided and subject to conditions contained in a program, agreed to by both the Board and Lessee, designed to alleviate or prevent further subsidence.

(d) Notwithstanding any agreement by the State to any such program, the Board may, upon receipt of evidence of further such subsidence occurring subsequent to the resumption of operations under such program, notify Lessee to again suspend operations in accordance with the provisions of this Section, and Lessee agrees to so suspend operations.

During any such period of suspension in whole or in part pursuant to this Section, the rental, minimum royalty, drilling, offset, and production obligations of Lessee shall likewise be suspended in whole or in part to the extent and only to the extent that such rental, minimum royalty, drilling, offset, and production obligations are rendered impracticable or unreasonable as a result of the notice to supend issued by the State pursuant to this Section.

The rights reserved and retained by the Board under this Section shall be exercisable to the extent and only to the extent that such exercise is permitted by law at the time of such exercise.

APPENDIX G

CALIFORNIA ENVIRONMENTAL QUALITY ACT
OF 1970 AS AMENDED
(Public Resources Code)

2100. The Legislature finds and declares as follows:

(a) The maintenance of a quality environment for the people of this state now and in the future is a matter of statewide concern.

(b) It is necessary to provide a high-quality environment that at all times is healthful and pleasing to the senses and intellect of man.

(c) There is a need to understand the relationship between the maintenance of high-quality ecological systems and the general welfare of the people of the state, including their enjoyment of the natural resources of the state.

(d) The capacity of the environment is limited, and it is the intent of the Legislature that the government of the state take immediate steps to identify any critical thresholds for the health and safety of the people of the state and take all coordinated actions necessary to prevent such thresholds being reached.

(e) Every citizen has a responsibility to contribute to the preservation and enhancement of the environment.

(f) The interrelationship of policies and practices in the management of natural resources and waste disposal requires systematic and concerted efforts by public and private interests to enhance environmental quality and to control environmental pollution.

(g) It is the intent of the Legislature that all agencies of the state government which regulate activities of private individuals, corporations, and public agencies which are found to affect the quality of the environment, shall regulate such activities so that major consideration is given to preventing environmental damage.

21001. The Legislature further finds and declares that it is the policy of the state to:

(a) Develop and maintain a high-quality environment now and in the future, and take all action necessary to protect, rehabilitate, and enhance the environmental quality of the state.

(b) Take all action necessary to provide the people of this state with clean air and water, enjoyment of aesthetic, natural, scenic, and historic environmental qualities, and freedom from excessive noise.

(c) Prevent the elimination of fish or wildlife species due to man's activities, insure that fish and wildlife populations do not drop below self-perpetuatig levels, and preserve for future generations representations of all plant and animal communities and examples of the major periods of California history.

(d) Ensure that the long-term protection of the environment shall be the guiding criterion in public decisions.

(e) Create and maintain conditions under which man and nature can exist in productive harmony to fulfill the social and economic requirements of present and future generations.

(f) Require governmental agencies at all levels to develop standards and procedures necessary to protect environmental quality.

(g) Require governmental agencies at all levels to consider qualitative factors as well as economic and technical factors and long-term benefits and costs, in addition to short-term benefits and costs and to consider alternatives to proposed actions affecting the environment.

21050. This division shall be known and may be cited as the Environmental Quality Act of 1970.

21060. Unless the context otherwise requires, the definitions in this chapter govern the construction of this division.

21060.3 "Emergency" means a sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services. "Emergency" includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage.

21060.5 "Environment" means the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, noise, objects of historic and aesthetic significance.

21061. "Environmental impact report" means a detailed statement setting forth the matters specified in Section 21100. It includes any comments on an environmental impact report which are obtained pursuant to Section 21104 or 21153, or which are required to be obtained pursuant to this division.

An environmental impact report is an informational document which, when its preparation is required by this division, shall be considered by every public agency prior to its approval or disapproval of a project. The purpose of an environmental impact report is to provide public agencies with detailed information about the effect which a proposed project is likely to have on the environment; to list ways in which any adverse effects of such a project might be minimized and to suggest alternatives to such a project.

21061.1 "Feasible" means capable of being accomplished in successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

21062. "Local agency" means any public agency other than a state agency, board, or commission. For purposes of this division, a redevelopment agency and a local agency formation commission are local agencies, and neither is a state agency, board or commission.

21063. "Public agency" includes any state agency, board, or commission, any county, city and county, city, regional agency, public district, redevelopment agency, or other political subdivision.

21064. "Negative declaration" means a written statement briefly describing the reasons that a proposed project will not have a significant effect on the environment and does not require the preparation of an environmental impact report.

21065. "Project" means the following:

(a) Activities directly undertaken by a public agency.

(b) Activities undertaken by a person which are supported in whole or in part through contracts, grants, subsidies, loans, or other forms of assistance from one or more public agencies.

(c) Activities involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies.

21066. "Person" includes any person, firm, association, organization, partnership, business, trust, corporation, company, district, county, city, town, the state, and any of the agencies and the political subdivisions of such entities.

21067. "Lead agency" means the public agency which has the principal responsibility for carrying out or approving a project which may have a significant effect upon the environment.

21068. "Significant effect on the environment" means a substantial, or potentially substantial, adverse change in the environment.

21069. "Responsible agency" means a public agency, other than the lead agency, which has responsibility for carrying out or approving a project.

21080. (a) Except as otherwise provided in this division, this division shall apply to discretionary projects proposed to be carried out or approved by public agencies, including, but not limited to, the enactment and amendment of zoning ordinances, the issuance of zoning variances, the issuance of conditional use permits and the approval of tentative subdivision maps (except where such a project is exempt from the preparation of an environmental impact report pursuant to Section 21166).

(b) This division shall not apply to the following:

(1) Ministerial projects proposed to be carried out or approved by public agencies.

(2) Emergency repairs to public service facilities necessary to maintain service.

(3) Projects undertaken, carried out, or approved by a public agency to maintain, repair, restore, demolish, or replace property or facilities damaged or destroyed as a result of a disaster in a disaster-stricken area in which a state of emergency has been proclaimed by the Governor pursuant to Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code.

(4) Specific actions necessary to prevent or mitigate an emergency.

(5) Projects which a public agency rejects or dissapproves.

(6) Actions undertaken by a public agency relating to any thermal powerplant site or facility, including the expenditure, obligation, or encumbrance of funds by a public agency for planning, engineering, or design purposes, or for the conditional sale or purchase of equipment, fuel, water (except ground water), steam, or power for such a thermal powerplant, if the powerplant site and related facility will be the subject of an environmental impact report or negative declaration or other document, or documents, prepared pursuant to a regulatory program certified pursuant to Section 21080.5, which will be prepared by the State Energy Resources Conservation and Development Commission, by the Public Utilities Commission, or by the city or county in which the powerplant and related facility would be located; provided that such environmental impact report, negative declaration or other document, or documents, shall include the environmental impacts, if any, of the action described in this paragraph.

(7) Activities or approvals necessary to the bidding for, hosting or staging or, and funding or carrying out of, an Olympic games under the authority of the International Olympic Committee, except for the construction of facilities necessary for such Olympic games.

(8) The establishment, modification, structuring, restructuring, or approval of rates, tolls, fares or other charges by public agencies which the public agency finds are the purpose of (1) meeting operating expenses, including employee wage rates and fringe benefits, (2) purchasing or leasing supplies, equipment or materials, (3) meeting financial reserve needs and requirements, (4) obtaining funds for capital projects, necessary to maintain service within existing service areas, or (5) otaining funds necessary to maintain such intra-city transfers as are authorized by city charter. The public agency shall incorporate written findings in the record of any proceeding in which an exemption under this paragraph is claimed setting forth with specificity the basis for the claim of exemption.

(9) Actions taken prior to January 1, 1982, by a public agency to implement the transition from the property taxation system in effect prior to June 1, 1978, to the system provied for by Article XIII A of the California Constitution. Such actions shall be limited to projects defined in subdivision (a) or (b) of Section 21065 which inititate or increase fees, rates, or charges charged for any existing public service, program, or activity; reduce or eliminate the availability of an existing public service, program, or activity; close publicly owned or operated facilities; or reduce or eliminate the availability of an existing publicly owned transit service, program, or activity.

(10) All classes of projects designated pursuant to Secton 21084.

(11) A project for the institution or increase of passenger or commuter service on rail lines already in use, including the modernization of existing stations and parking facilities.

(12) A project for the institution or increase of passenger or commuter service on high occupany vehicle lanes already in use, including the modernization of existing stations and parking facilities.

(13) Facility extensions not to exceed four miles in length which are required for transfer of passengers from or to exclusive public mass transit guideway or busway public transit services.

(14) A project for the development of a regional transportation improvement program or the state transportation improvement program.

(15) Any project or portion thereof located in another state which will be subject to environmental impact review pusuant to the National Environmental Policy Act of 1969 or similar state laws of that state. Any emissions or discharges that would have a significant effect on the environment in the State of California are subject to this division.

(c) In the event that a lead agency determines that a proposed project, not otherwise exempt from the provisions of this division, does not have a significant effect on the environment, such lead agency shall adopt a negative declaration to that effect.

21080.1. The lead agency shall have the responsibility for determining whether an environmental impact report or a negative declaration shall be required for any project subject to the provisions of this division. Such determination shall be final and conclusive on all persons, including responsible agencies, unless challenged as provided in Section 21167.

21080.2. In the case of a project described in subdivision (c) of Section 21065, the determination required by Section 21080.1 shall be made within 45 days from the date on which an application for a project has been received and accepted as complete by the lead agency.

21080.3. (a) Prior to determining whether a negative declaration or environmental impact report is required for a project, the lead agency shall consult with all responsible agencies and with any other public agency which has jurisdiction by law over natural resources affected by the project which are held in trust for the people of the State of California.

(b) In order to expedite the requirements of subdivision (a), the Office of Planning and Research, upon request of a lead agency, shall assist such lead agency in determining the various responsible agencies for a proposed project. In the case of a project described in subdivision (c) of Section 21065, such a request may also be made by the project applicant.

21080.4. (a) In the event that a lead agency determines that an environmental impact report is required for a project, such lead agency shall immediately send notice of such determination by certified mail or an equivalent procedure to each responsible agency and to those public agencies having jurisdiction by law over natural resources affected by the project which are held in trust for the people of the State of California. Upon receipt of such notice, each responsible agency shall specify to the lead agency the scope and content of the environmental information which is germane to such responsible agency's statutory responsibilities in connection with the proposed project and which, pursuant to the requirements of this division, shall be included in the environmental impact report. Such information shall be specified in writing and shall be communicated to the lead agency by certified mail or equivalent procedure not later than 45 days after receipt of the notice of the lead agency's determination. The lead agency shall request similar guidance from appropriate federal agencies.

(b) In order to expedite the requirements of subdivision (a), the lead agency or any responsible agency or public agency having jurisdiction by law over natural resources affected by the project which are held in trust for the people of the State of California may request one or more meetings between representatives of such agencies for the purpose of assisting the lead agency to determine the scope and content of the environmental information such responsible agency may require. In the case of a project described in subdivision (c) of Section 21065, such a request may also be made by the project applicant. Such meetings shall be convened by the lead agency as soon as possible, but no later than 30 days, after they have been requested.

(c) In order to expedite the requirements of subdivision (a), the Office of Planning and Research, upon request of a lead agency, shall assist such lead agency in determining the various responsible agencies and any federal agencies which have responsibility for carrying out or approving a proposed project. In the case of a project described in subdivision (c) of Section 21065, such a request may also be made by the project applicant.

(d) In the event that a state agency is a responsible agency or a public agency having jurisdiction by law over natural resources affected by the project which are held in trust for the people of the State of California, subject to the requirements of subdivision (a), the Office of Planning and Research shall ensure that the information required by subdivision (a) is transmitted to the lead agency within the required time period.

21080.5. (a) When the regulatory program of a state agency, board, or commission requires a plan or other written documentation, containing environmental information and complying with the requirements of paragraph (3) of subdivision (b) of this section, to be submitted in support of the issuance to a person, other than a public agency, of a lease, permit, license, certificate, or other entitlement for use, such plan or other written documentation may be submitted in lieu of the environmental impact report required by this division; provided, that the Secretary of the Resources Agency has certified the regulatory program pursuant to this section.

(b) The provisions of this section shall apply only to regulatory programs or portions thereof which involve:

(1) The issuance to a person of a lease, permit, license, certificate, or other entitlement for use; or

(2) The adoption or approval of standards, rules, regulations or plans for use in the regulatory program.

(c) A regulatory program certified pursuant to this section is exempt from the provisions of Chapter 3 (commencing with Section 21100) and Chapter 4 (commencing with Section 21150) of this division and Section 21167.

(d) In order to qualify for certification pursuant to this section, a regulatory program shall require utilization of an interdisciplinary approach which will ensure the integrated use of the natural and social sciences in decisionmaking and shall meet all the following criteria.

(1) The enabling legislation of the regulatory program shall:

(i) Include protection of the environment among its principal purposes.

(ii) Contain authority for the administering agency to promulgate rules and regulations for the protection of the environment, guided by standards set forth in the enabling legislation.

(2) The rules and regulations adopted by the administering agency shall:

(i) Require that an activity will not be approved or adopted as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen any significant adverse impact which the activity may have on the environment.

(ii) Include guidelines for the orderly evaluation of proposed activities and the preparation of the plan or other written documentation in a manner consistent with the environmental protection purposes of the regulatory program.

(iii) Require the administering agency to consult with all public agencies which have jursidiction by law, with respect to the activity involving the issuance of the lease, permit, license, certificate, or other entitlement for use.

(iv) Require that final action on the issuance of a lease, permit, license, certificate, or other entitlement for use include the written responses of the issuing authority to significant environmental pionts raised during the evaluation process.

(v) Require the filing of a notice of the decision by the administering agency on the proposed activity with the Secretary of the Resources Agency. Such notices shall be available for public inspection, and a list of such notices shall be posted on a weekly basis in the Office of the Resources Agency. Each such list shall remain posted for a period of 30 days.

(vi) Require notice of the filing of the plan or other written documentation to be made to the public and to any person who requests, in writing, such notification. The notification shall be made in a manner that will provide the public or any such person with sufficient time to review and comment on such filing.

(3) The plan or other written documentation required by the regulatory program shall:

(i) Include a description of the project with alternatives to the project, and mitigation measures to minimize any significant adverse environmental impact.

(ii) Be available for a reasonable time for review and comment by other public agencies and the general public.

(c) The Secretary of the Resources Agency shall certify a regulatory program which the secretary determines meets all the qualifications for certification set forth in this section and withdraw certification on determination that the regulatory program no longer meets such qualifications. Certification and withdrawal of certification shall occur only after compliance with Chapter 4.5 (commencing with Section 11371) of Part 1 of Division 3 of Title 2 of the Government Code.

(d) Any action or proceeding to attack, review, set aside, void, or annul a determination or decision of a state agency, board, or commission to issue a lease, permit, license, certificate, or other entitlement for use under a regulatory program which has been certified pursuant to this section on the basis that the plan or other written documentation submitted in support of such issuance does not comply with the provisions of this section shall be commenced no later than 30 days from the date of the filing of notice of issuance.

(e) In determining whether or not a regulatory program meets the qualifications for certification set forth in this section, the inquiry of the Secretary of the Resources Agency shall extend only to the question of whether the regulatory program meets the generic requirements of subdivision (d). The inquiry shall not extend to individual decisions to be reached under such regulatory program, including, the nature of specific alternatives or mitigation measures which might be proposed to lessen any significant adverse environmental effects of the activity.

In the event that the Secretary of the Resources Agency determines that the regulatory program submitted for certification does not meet the qualifications for certification set forth in this section, the secretary shall adopt findings setting forth the reasons for such determination.

(f) After a regulatory program has been certified pursuant to this section, any proposed change in such program which could affect compliance with the qualifications for certification specified in subdivision (d) may be submitted to the Secretary of the Resources Agency for review and comment. The scope of the secretary's review shall extend only to the question of whether the regulatory program meets the generic requirements of subdivision (d). The review shall not extend to individual decisions to be reached under such regulatory program, including specific alternatives or mitigation measures which might be proposed to lessen any significant adverse environmental effects of the activity. The secretary shall have 30 days after receipt of such proposed change to notify the state agency, board, or commission whether the proposed change will alter the regulatory program so that it no longer meets the qualification for certification established in this section and will result in a withdrawal of certification as provided in this section.

(g) Any action or proceeding to attack, review, set aside, void, or annul a determination or decision of a state agency, board, or commission approving or adopting a proposed activity under a regulatory program which has been certified pursuant to this section on the basis that the plan or other written documentation prepared pursuant to paragraph (3) of subdivision (d) does not comply with the provisions of this section shall be commenced no later than 30 days from the date of the filing of notice of the approval or adoption of the activity.

(h) Any action or proceeding to attack, review, set aside, void or annul a determination of the Secretary of the Resources Agency to certify a regulatory program pursuant to this section on the basis that the regulatory program does not comply with the provisions of this section shall be commenced within 30 days after certification by the secretary.

In any action brought under this subdivision, the inquiry shall extend only to whether there was a prejudicial abuse of discretion by the Secretary of the Resources Agency. Abuse of discretion is established if the secretary has not proceeded in a manner required by law or if the determination is not supported by substantial evidence.

(i) For purposes of this section, any county agricultural commissioner shall be considered a state agency.

21080.7. (a) No environmental impact report or negative declaration shall be required for any project involving the construction of housing or neighborhood commercial facilities in an urbanized area if the lead agency does all of the following:

(1) Finds, after giving notice pursuant to subdivision (b) or (c) of Section 21092 and following the procedure prescribed by law or regulation which would be necessary to make a determination pursuant to Section 21080.1,

(i) That such project is consistent with a specific plan which has been adopted pursuant to Article 8 (commencing with Section 65450), Article 9 (commencing with Section 65500), and Article 10 (commencing with Section 65550) of Chapter 3 of Title 7 of the Government Code or, in the coastal zone, a local coastal program certified pursuant to Article 2 (commencing with Section 30510) of Chapter 6 of Division 20,

(ii) That such plan or program was adopted pursuant to the procedure established by Article 9 (commencing with Section 65500) of Chapter 3 of Title 7 of the Government Code not more than five years prior to the finding made pursuant to this section, and,

(iii) That such plan or program has been the subject of an environmental impact report, and

(iv) That the environmental impact report is sufficiently detailed so that the significant adverse effects of the project on the environment and measures necessary to mitigate or avoid any such effects can be determined, including significant physical effects on existing structures and neighborhoods, of historical or aesthetic significance if any exist in the area covered by the plan or program, and measures necessary to mitigate such effects.

(2) Makes one or more of the findings as required pursuant to Section 21081.

(3) Files a notice of the decision on the proposed activity with the county clerk. Such notices shall be available for public inspection, and a list of such notices shall be available for public inspection, and a list of such notices shall be posted on a weekly basis in the office of the county clerk. Each such list shall remain posted for a period of 30 days.

(b) As used in this section:

(1) "Neighborhood commercial facilities" means those commercial facilities which are an integral part of a project involving the construction of housing and which will serve the residents of such housing.

(2) "Urbanized area" means a central city or cities and surrounding closely settled territory, as defined by the United States Department of Commerce Bureau of the Census in the Federal Register, Volume 39, Number 85, for Wednesday, May 1, 1974, at pages 15202-15203, and as periodically updated.

21080.9. Local coastal programs or long-range land use development; university or governmental activities and approvals; non-application of division.

This division shall not apply to activities and approvals by any local government, as defined in Section 30109, or any state university or college, as defined in Section 30119, as necessary for the preparation and adoption of a local coastal program or long-range land use development plan pursuant to Division 20 (commencing with Section 30000); provided, however, that certification of a local coastal program or long-range land use development plan by the California Coastal Commission pursuant to Chapter 6 (commencing with Section 30500) of Division 20 shall be subject to the requirements of this division. For the purpose of Section 21080.5, a certified local coastal program or long-range land use development plan constitutes a plan for use in the California Coastal Commission's regulatory program.

21081. Pursuant to the policy stated in Sections 21002 and 21002.1, no public agency shall approve or carry out a project for which an environmental impact report has been completed which identifies one or more significant effects thereof unless such public agency makes one, or more, of the following findings:

(a) Changes or alterations have been required in, or incorporated into, such project which mitigate or avoid the significant environmental effects thereof as identified in the completed environmental impact report.

(b) Such changes or alterations are within the responsibility and jurisdiction of another public agency and such changes have been adopted by such other agency, or can and should be adopted by such other agency.

(c) Specific economic, social, or other considerations make infeasible the mitigation measures or project alternatives identified in the environmental impact report.

21082. All public agencies shall adopt by ordinance, resolution, rule or regulation, objectives, criteria and procedures for the evaluation of projects and the preparation of environmental impact reports pursuant to this division. The objectives, criteria and procedures shall be consistent with the provisions of this division and with the guidelines adopted by the Secretary of the Resources Agency pursuant to Section 21083. Such objectives, criteria, and procedures shall be adopted by each public agency no later than 60 days after the Secretary of the Resources Agency has adopted guidelines pursuant to Section 21083.

21082.1. Any environmental impact report or negative declaration prepared pursuant to the requirement of this division shall be prepared directly by, or under contract to, a public agency.

This section is not intended to prohibit, and shall not be construed as prohibiting, any person from submitting information to the public agency responsible for preparing an environmental impact report or negative declaration. Such information may be submitted in any format and may be included in whole or in part in any such report or declaration.

21083. The Office of Planning and Research shall prepare and develop proposed guidelines for the implementation of this division by public agencies. Such guidelines shall include objectives and criteria for the orderly evaluation of projects and the preparation of environmental impact reports in a manner consistent with this division.

Such guidelines shall specifically include criteria for public agencies to follow in determining whether or not a proposed project may have a "significant effect on the environment." Such criteria shall require a finding of "significant effect on the environment" if any of the following conditions exist:

(a) A proposed project has the potential to degrade the quality of the environment, curtail the range of the environment, or to achieve short-term, to the disadvantage of long-term, environmental goals;

(b) The possible effects of a project are individually limited but commulatively considerable;

(c) The environmental effects of a project will cause substantial adverse effects on human beings, either directly or indirectly.

Such guidelines shall also include procedures for determining the lead agency pursuant to the provisions of Section 21165.

The Office of Planning and Research shall develop and prepare such proposed guidelines as soon as possible and shall transmit them immediately to the Secretary of the Resources Agency. No later than 60 days after the effective date of this section the Secretary of the Resources Agency shall certify and adopt such guidelines pursuant to Chapter 4.5 (commencing with Secton 11371) of Part 1, Division 3, Title 2 of the Government Code, which shall become effective upon the filing thereof, provided that such guidelines shall not be adopted without compliance with Sections 11423, 11424, and 11425 of the Government Code.

21083.5. The guidelines prepared and adopted pursuant to Section 21083 shall provide that when an environmental impact statement has been, or will be, prepared for the same project pursuant to the requirements of the national Environmetnal Policy Act of 1969 and implementing regulations thereto, all or any part of such statement may be submitted in lieu of all or any part of an environmental impact report required by this division, provided that such statement, or the part thereof so used, shall comply with the requirements of this division and the guidelines adopted pursuant thereto.

21083.6. In the event that a project requires both an environmental impact report prepared pursuant to the requirements of this division and an environmental impact statement prepared pursuant to the requirements of the National Environmental Policy Act of 1969, an applicant may request and the lead agency may waive the time limits established pursuant to Section 21100.2 or 21151.5 if it finds that additional time is required to prepare a combined environmental impact report-environmental impact statement and that the time required to prepare such a combined document would be shorter than that required to prepare each document separately.

21083.7. In the event that a project requires both an environmental impact report prepared pursuant to the requirements of this division and an environmental impact statement prepared pursuant to the requirements of the National Environmental Policy Act of 1969, the lead agency shall, whenever possible, use the environmental impact statement as such environmental impact report as provided in Section 21083.5. In order to implement the provisions of this section, each lead agency to which this section is applicable shall consult, as soon as possible, with the agency required to prepare such environmental impact statement.

21084. The guidelines prepared and adopted pursuant to Section 21083 shall include a list of classes of projects which have been determined not to have a significant effect on the environment and which shall be exempt from the provisions of this division. In adopting the guidelines, the Secretary of the Resources Agency shall make a finding that the list or classification of projects referred to in this section do not have a significant effect on the environment.

21085. All classes of projects designated pursuant to Section 21084 shall be exempt from the provisions of this division.

21086. A public agency may, at any time, request the addition or deletion of a class of projects, to the list designated pursuant to Section 21084. Such a request shall be made in writing to the Office of Planning and Research and shall include information supporting the public agency's positon that such class of projects does, or does not, have a significant effect on the environment.

The Office of Planning and Research shall review each such request and, as soon as possible, shall submit its recommendation to the Secretary of the Resources Agency. Following the receipt of such recommendation, the Secretary of the Resources Agency may add or delete the class of projects to the list of classes of projects designated pursuant to Section 21084 which are exempt from the requirements of this division.

The addition or deletion of a class of projects, as provided in this section, to the list specified in Section 21084 shall constitute an amendment to the guidelines adopted pursuant to Section 21083 and shall be adopted in the manner prescribed in Sections 21083, 21084, and 21087.

21087. The Office of Planning and Research shall periodically review the guidelines adopted pursuant to Section 21083 and shall recommend proposed changes or amendments to the Secretary of the Resources Agency. Changes or amendments to the guidelines shall be adopted by the Secretary of the Resources Agency in the same manner as provided in Section 21083 for the adoption of the original guidelines.

21088. The Secretary of the Resources Agency shall provide for the timely distribution to all public agencies of the guidelines and any amendments or changes thereto. In addition, the Secretary of the Resources Agency may provide for publication of a bulletin to provide public notice of the guidelines, or any amendments or changes thereto, and of the completion of environmental impact reports prepared in compliance with this division.

21089. A public agency may charge and collect a reasonable fee from any person proposing a project subject to the provisions of this division in order to recover the estimated costs incurred by the public agency in preparing an environmental impact report for such project.

21090. For all purposes of this division all public and private activities or undertakings pursuant to or in furtherance of a redevelopment plan shall be deemed a single project.

21090.1. For all purposes of this division, a geothermal exploratory project shall be deemed to be separate and distinct from any subsequent geothermal field development project as defined in Section 65928.5 of the Government Code.

21092. Any public agency which is preparing an environmental impact report or a negative declaration shall provide public notice of such fact within a reasonable period of time prior to final adoption by the public agency of such environmental impact report or negative declaration. Notice shall be given to all organizations and individuals who have previously requested such notice and shall also be given by at least one of the following procedures:

(a) Publication, no fewer times than required by Section 6061 of the Government Code, by the public agency in a newspaper of general circulation in the area affected by the proposed project.

(b) Posting of notice by the public agency on- and off-site in the area where the project is to be located.

(c) Direct mailing to owners of contiguous property.

The alternatives for providing notice specified in subdivisions (a) to (c), inclusive, shall not preclude a public agency from providing additional notice by other means if such agency so desires, nor shall the requirements of this section preclude a public agency from providing the public notice required herein at the same time and in the same manner as public notice otherwise required by law for such project.

21100. All state agencies, boards, and commissiones shall prepare, or cause to be prepared by contract, and certify the completion of an environmental impact report on any project they propose to carry out or approve which may have a significant effect on the environment. Such a report shall include a detailed statement setting forth the following:

(a) The significant environmental effects of the proposed project.

(b) Any significant environmental effects which cannot be avoided if the project is implemented.

(c) Mitigation measures proposed to minimize the significant environmental effects including, but not limited to measures to reduce wasteful, inefficient, and unnecessary consumption of energy.

(d) Alternatives to the proposed project.

(e) The relationship between local short-term uses of man's environment and maintenance and enhancement of long-term productivity.

(f) Any significant irreversible environmental changes which would be involved in the proposed action should it be implemented.

(g) The growth-inducing impact of the proposed project.

The report shall contain a statement briefly indicating the reasons for determining that various effects of a project are not significant and consequently have not been discussed in detailed in the environmental impact report.

21100.1. The information described in subdivisions (e) and (f) of Section 21100 shall be required only in environmental impact reports prepared in connection with the following:

(a) Th adoption, amendment, or enactment of a plan, policy, or ordinance of a public agency.

(b) The adoption by a local agency formation commission of a resolution making determinations.

(c) A project which would be subject to the requirement for preparing an environmental impact statement pursuant to the requirements of the National Environmental Policy Act of 1969.

21101. In regard to any proposed federal project in this state which may have a significant effect on the environment and on which the state officially comments, the state officials responsible for such comments shall include in their report a detailed statement setting forth the matters specified in Section 21100 prior to transmitting the comments of the state to the federal government. No report shall be transmitted to the federal government unless it includes such a detailed statement as to the matters specified in Section 21100.

21102. No state agency, board, or commission shall request funds, nor shall any state agency, board, or commission which authorizes expenditures of funds, other than funds appropriated in the Budget Act, authorize funds for expenditure for any project, other than a project involving only feasibility or planning studies for possible future actions which the agency, board, or commission has not approved, adopted or funded, which may have a significant effect on the environment unless such request or authorization is accompanied by an environmental impact report.

Feasibility and planning studies exempted by this section from the preparation of an environmental impact report shall nevertheless include consideration of environmental factors.

21104. Prior to completing an environmental impact report, the lead agency shall consult with, and obtain comments from each responsible agency and any public agency which has jurisdiction by law with respect to the project, and may consult with any person who has special expertise with respect to any environmental impact involved.

21105. The lead state agency shall include the environmental impact report as a part of the regular project report used in the existing review and budgetary process. It shall be available to the Legislature. It shall also be available for inspection by any member of the general public who may secure a copy thereof by paying for the actual cost of such a copy. It shall be filed by the state lead agency with the appropriate local planning agency of any city, county, or city and county which will be affected by the project.

21106. All state agencies, boards, and commissions shall request in their budgets the funds necessary to protect the environment in relation to problems caused by their activities.

21108. Whenever a state agency, board, or commission approves or determines to carry out a project which is subject to the provisions of this division, it shall file notice of such approval or such determination with the Secretary of the Resources Agency. Such notice shall indicate the determination of the agency, board, or commission whether the project will, or will not, have a significant effect on the environment and shall indicate whether an environmental impact report has been prepared pursuant to the provisions of this division.

(b) Whenever a state agency, board, or commission determines that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172, and it approves or determines to carry out such project, it , or the person specified in subdivision (b) or (c) of Section 21065, may file notice of such determination with the Secretary of the Resources Agency. Any notice filed pursuant to this subdivision by a person specified in subdivision (b) or (c) of Section 21065 shall have a certificate of determination attached to it issued by the state agency, board, or commission responsible for making the determination that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172. The certificate of determination may be in the form of a certified copy of any existing document or record of the state agency, board, or commission.

(c) All notices filed pursuant to this section shall be available for public inspection, and a list of such notices shall be posted on a weekly basis in the Office of the Resources Agency. Each such list shall remain posted for a period of 30 days.

21150. State agencies, boards, and commissions responsible for allocating state or federal funds on a project-by-project basis to local agencies for any project which may have a significant effect on the environment, shall require from the responsible local governmental agency a detailed statement setting forth the matters specified in Section 21100 prior to the allocation of any funds other than funds solely for projects involving only feasibility or planning studies for possible future actions which the agency, board, or commission has not approved, adopted, or funded.

21151. All local agencies shall prepare, or cause to be prepared by contract, and certify the completion of an environmental impact report on any project they intend to carry out or approve which may have a significant effect on the environment. When a report is required by Section 65402 of the Government Code, the environmental impact report may be submitted as a part of that report.

21151.5. Local agencies shall establish, by ordinance or resolution, time limits, not to exceed one year, for completing environmental impact reports and negative declarations for projects described in subdivision (c) of Section 21065. Such ordinances or resolutions may establish different time limits for different types or classes of projects, but all such limits shall be measured from the date on which an application requesting approval of such project is received by the local agency. The ordinances or resolutions required by this section may provide for a reasonable extension of such time period in the event that unforeseen circumstances justify additional time and that the project applicant consents thereto.

21152. Whenever a local agency approves or determines to carry out a project which is subject to the provisions of this division, it shall file notice of such approval or such determination with the county clerk of the county, or counties, in which the project will be located. Such notice shall indicate the determination of the local agency whether the project will, or will not, have a significant effect on the environment and shall indicate whether an environmental impact report has been prepared pursuant to the provisions of this division.

(b) Whenever a local agency determines that a project is not subject to the provisions of this division, it shall file notice of such approval or such determination with the county clerk of the county, or counties, in which the project will be located. Such notice shall indicate the determination of the local agency whether the project will, or will not, have a significant effect on the environment and shall indicate whether an environmental impact report has been prepared pursuant to the provisions of this division.

(b) Whenever a local agency determines that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172, and it approves or determines to carry out such a project, it, or the person specified in subdivision (b) or (c) of Section 21065, may file notice of such determination with the county clerk of the county, or counties, in which the project will be located. Any notice filed pursuant to this subdivision by a person specified in subdivision (b) or (c) of Section 21065 shall have a certificate of determination attached to it issued by local agency responsible for making the determination that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172. The certificate of determination may be in the form of a certified copy of an existing document or record of the local agency.

(c) All notices filed pursuant to this section shall be available for public inspection, and a list of such notices shall be posted on a weekly basis in the office of the county clerk. Each such list shall remain posted for a period of 30 days.

21153. Prior to completing an environmental impact report, every local lead agency shall consult with, and obtain comments from each responsible agency and any public agency which has jurisdiction by law with respect to the project, and may consult with any person who has special expertise with respect to any environmental impact involved.

21154. Whenever any state agency, board, or commission issues an order which requires a local agency to carry out a project which may have a significant effect on the environment, any environmental impact report which the local agency may prepare shall be limited to consideration of those factors and alternatives which will not conflict with such order.

21155. The Secretary of the Resources Agency shall develop an economic practices manual which may be used by local agencies in assessing the economic efficiency and fiscal impact of alternative land use proposals by local agencies and as an aid in evaluating private land use proposals.

The manual shall present economic and fiscal criteria for local agencies to use in developing comprehensive and multidisciplined programs and procedures for evaluating alternative land use policies and private land use proposals. The manual shall include a step-by-step program which local agencies may follow, including, but not limited to, sources of data, methods of summarizing and using the data, formulas for evaluating the economic efficiency and fiscal impact of land use decisions, a guideline on how to prepare a simple statement of results, and a means for equating economic factors with social and environmental factors.

The Secretary of the Resources Agency may obtain private counseling in the preparation of the manual. On or before January 1, 1975, the Secretary of the Resources Agency shall submit a proposed manual to the Legislature for its review. It is the intent of the Legislature hereby to permit the Legislature to review the manual and to comment thereon prior to its final adoption by the Secretary of the Resources Agency and its distribution to local agencies.

21160. Whenever any person applies to any public agency for a lease, permit, license, certificate, or other entitlement for use, the public agency may require that person to submit data and information which may be necessary to enable the public agency to determine whether the proposed project may have a significant effect on the environment or to prepare an environmental impact report.

If any or all of the information so submitted is a "trade secret" as defined in Section 6254.7 of the Government Code by those submitting that information, it shall not be included in the impact report or otherwise disclosed by any public agency. This section shall not be construed to prohibit the exchange of properly designated trade secrets between public agencies who have lawful jurisdiction over the preparation of the impact report.

21161. Whenever a public agency has completed an environmental impact report, it shall cause a notice of completion of such report to be filed with the Secretary of the Resources Agency. The notice of completion shall briefly identify the project and shall indicate that an environmental impact report has been prepared. Failure to file the notice required by this section shall not affect the validity of a project.

21165. When a project is to be carried out or approved by two or more public agencies, the determination of whether the project may have a significant effect on the environment shall be made by the lead agency and such agency shall prepare, or cause to be prepared by contract, the environmental impact report for the project, if such a report is required by this division. In the event that a dispute arises as to which is the lead agency, any public agency, or in the case of a project described in subdivision (c) of Section 21065, the applicant for such project may submit the question to the Office of Planning and Research, and the Office Planning and Research shall designate within 30 days of receiving such request the lead agency, giving due consideration to the capacity of such agency to adequately fulfill the requirements of this division.

21166. When an environmental impact report has been prepared for a project pursuant to this division, no subsequent or supplemental environmental impact report shall be required by the lead agency or any responsible agency unless either of the following occurs:

(a) Substantial changes are proposed in the project which will require major revisions of the environmental impact report.

(b) Substantial changes occur with respect to the circumstances under which the project is being undertaken which will require major revision in the environmental impact report.

(c) New information which was not known and could not have been known at the time the environmental impact report was certified as complete, becomes available.

21167. Any action or proceeding to attack, review, set aside, void, or annul the following acts or decisions of a public agency on the grounds of noncompliance with this division shall be commenced as follows:

(a) An action or proceeding alleging that a public agency is carrying out or has approved a project which may have a significant effect on the environment without having determined whether the project may have a significant effect on the environment shall be commenced within 180 days of the public agency's decision to carry out or approve the project, or, if a project is undertaken without a formal decision by the public agency, within 180 days after commencement of the project.

(b) Any action or proceeding alleging that a public agency has improperly determined whether a project may have a significant effect on the environment shall be commenced within 30 days after the filing of the notice required by subdivision (a) of Section 21108 or subdivision (a) of Section 21152.

(c) Any action or proceeding alleging that an environmental impact report does not comply with the provisions of this division shall be commenced within 30 days after the filing of the notice required by subdivision (a) of Section 21108 or subdivision (a) of Section 21152 by the lead agency.

(d) Any action or proceeding alleging that a public agency has improperly determined that a project is not subject to the provisions of this division pursuant to subdivision (b) of Section 21080 or pursuant to Section 21085 or 21172 shall be commenced within 35 days after the filing by the public agency, or person specified in subdivision (b) or (c) of Section 21065, of the notice authorized by subdivision (b) of Section 21108 or subdivision (b) of Section 21152. If such notice has not been filed, such action or proceeding shall be commenced within 180 days of the public agency's decision to carry out or approve the project, or, if a project is undertaken without a formal decision by the public agency, within 180 days after commencement of the project.

(e) Any action or proceeding alleging that any other act or omission of a public agency does not comply with the provisions of this division shall be commenced within 30 days after the filing of the notice required by subdivision (a) of Section 21108 or subdivision (a) of Section 21152.

21167.2. If no action or proceeding alleging that an environmental impact report does not comply with the provisions of this division is commenced during the period prescribed in subdivision (c) of Section 21167, the environmental impact report shall be conclusively presumed to comply with the provisions of this division for purposes of its use by responsible agencies, unless the provisions of Section 21166 are applicable.

21167.3. (a) If an action or proceeding alleging that an environmental impact report or a negative declaration does not comply with the provisions of this division is commenced during the period described in subdivision (b) or (c) of Section 21167, and if an injunction or stay is issued prohibiting the project from being carried out or approved pending final determination of the issue of such compliance, responsible agencies shall assume that the environmental impact report or the negative declaration for the project does comply with the provisions of this division.

(b) In the event that an action or proceeding is commenced as described in subdivision (a) but no injunction, or similar relief is sought and granted, responsible agencies shall assume that the environmental impact report or negative declaration for the project does comply with the provisions of this division and shall approve or disapprove the project according to the timetable for agency action in Article 5 (commencing with Section

65950) of Chapter 4.5 of Division of 1 of Title 7 of the Government Code. Such approval shall constitute permission to proceed with the project at the applicant's risk pending final determination of such action or proceeding.

21167.4. In a writ of mandate proceeding alleging noncompliance with this division, the petitioner shall request a hearing within 90 days of filing the petition or otherwise be subject to dismissal on the court's own motion or on the motion or any party interested therein.

21167.5. Proof of prior service by mail upon the public agency carrying out or approving the project of a written notice of the commencement of any action or proceeding described in Section 21167 identifying the project shall be filed concurrently with the initial pleading in such action or proceeding.

21168. Any action or proceeding to attack, review, set aside, void or annul a determination or decision of a public agency, made as a result of a proceeding in which by law a hearing is required to be given, evidence is required to be taken and discretion in the determination of facts is vested in a public agency, on the grounds of noncompliance with the provisions of this division shall be in accordance with the provisions of Section 1094.5 of the Code of Civil Procedure.

.In any such action, the court shall not exercise its independent judgment on the evidence but shall only determine whether the act or decision is supported by substantial evidence in the light of the whole record.

21168.5. In any action or proceeding, other than an action or proceeding under Section 21168, to attack, review, set aside, void or annul a determination or decision of a public agency on the grounds of noncompliance with this division, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the agency has not proceeded in a manner required by law or if the determination or decision is not supported by substantial evidence.

21168.6. In any action or proceeding under Sections 21168 or 21168.5 against the Public Utilities Commission the writ or mandate shall lie only from the Supreme Court to such commission.

21168.7. Sections 21168 and 21168.5 are declaratory to existing law with respect to the judicial review of determinations or decisions of public agencies made pursuant to this division.

21169. Any project defined in subdivision (c) of Section 21065 undertaken, carried out or approved on or before the effective date of this section and the issuance by any public agency of any lease, permit, license, certificate or other entitlement for use executed or issued on or before the effective date of this section notwithstanding a failure to comply with this division, if otherwise legal and valid, is hereby confirmed, validated and declared legally efrective.

21170. (a) Section 21169 shall not operate to confirm, validate or give legal effect to any project the legality of which was being contested in a judicial proceeding in which proceeding the pleadings, prior to the effective date of this section, alleged facts constituting a cause of action for, or raised the issue of, a violation of this division and which was pending and underdetermined on the effective date of this section; provided, however, that Section 21169 shall operate to confirm, validate or give legal effect to any project to which this subdivision applies if, prior to the commencement of judicial proceedings and in good faith and in reliance upon the issuance by a public agency of any lease, permit, license, certificate or other entitlement of use, substantial construction and necessary materials have been incurred.

(b) Section 21169 shall not operate to confirm, validate or give legal effect to any project which had been determined in any judicial proceeding, on or before the effective date of this section to be illegal, void or ineffective because of noncompliance with this division.

21171. This division, except for Section 21169, shall not apply to the issuance of any lease, permit, license, certificate or other entitlement for use for any project defined in subdivision (c) of Section 21065 or to any project undertaken by a person which is supported in whole or in part through contracts with one or more public agencies until the 121st day after the effective date of this section. This section shall not apply to any project to which Section 21170 is applicable or to any successor project which is the same as, or substantially identical to, such a project.

This section shall not prohibit or prevent a public agency, prior to the 121st day after the effective date of this section, from considering environmental factors in connection with the approval or disapproval of a project and from imposing reasonable fees in connection therewith.

21172. This division shall not apply to any project undertaken, carried out or approved by a public agency to maintain, repair, restore, demolish or replace property or facilities damaged or destroyed as a result of a disaster in a disaster stricken area in which a state of emergency has been proclaimed by the Governor pursuant to Chapter 7 (commencing with Section 8550) of Division 1, Title 2 of the Government Code.

21172.5. Until the 121st day after the effective date of this section any objectives, criteria and procedures adopted by public agencies in compliance with this division shall govern the evaluation of projects defined in subdivisions (a) and (b) of Section 21065 and the preparation of environmental impact reports on such projects when required by this division.

Any environmental impact report which has been completed or on which substantial work has been performed on or before the 121st day after the effective date of this section, if otherwise legally sufficient, shall, when completed, be deemed to be in compliance with this division and no further environmental impact report shall be required except as provided in Section 21166.

21173. If any provision of this division or the application thereof to any person or circumstances is held invalid, such invalidity shall not affect other provisions or applications of this division which can be given effect without the invalid provison or application thereof, and to this end the provisions of this division are severable.

21174. No provision of this division is a limitation or restriction on the power or authority of any public agency in the enforcement or administration of any provision of law which it is specifically permitted or required to enforce or administer including, but not limited to, the powers and authority granted to the California Coastal Zone Conservation Commission or any regional coastal zone conservation commission pursuant to Division 18 (commencing with Section 27000) of the Public Resources Code. To the extent of any inconsistency or conflict between the provisions of the California Coastal Zone Conservation Act of 1972, Division 18 (commencing with Section 27000) of the Public Resources Code, and the provisions of this division, the provisions of Division 18 (commencing with Section 27000) of the Public Resources Code shall control.

APPENDIX H

I. Determination of compliance with emission limits (State of Texas). In most cases downwind samples will suffice; however, if the sampled properties are suspected of being influenced by an upwind source of H_2S, then both upwind and downwind samples will be taken. The concentration of H_2S in the "downwind sample" less the concentration in the "upwind sample" shall be used in determining whether the emissions from the property comply with the requirements of Rule 203 of this Regulation. Calculated maximum allowable emission rates or ground level concentrations which are obtained by the Method in Section II below may be used in determining whether a property is in compliance with the emission limits specified.

II. Calculations of H_2S Concentrations from Stack Samples and Measurements. The maximum allowable H_2S emission rate which may be made from a stack on a property to comply with the emission limit set forth in Rule 203 of this Regulation may be calculated by Sutton's equation which has been modified to consider the critical wind speed and to correspond to a 30 minute air sample. Additional credit on stack emissions can be obtained if the distance from the stack to the property line is greater than thirty (30) stack heights. Those properties with greater than 30 stack heights to the property line should contact the Executive Director to obtain the proper correction factor.

A. For exit stack gas for temperatures of less than 125°F.

1. Rule 203.1. The H_2S ambient air level is 0.08 ppm for 30 minutes.

$$Qa = 8 \times 10^{-4} V_s d_s^{2} \frac{1}{\left[\dfrac{d_s}{h_s}\right]^{1.29}} \qquad (1)$$

where:
Qa = emission rate, lbs/hr
V_s = stack exit velocity, ft/sec.
d_s = exit stack diameter, ft.
h_s = physical stack height, ft.
To plot Graph II, assume a basic stack height of 100 ft. and plot $\left[\frac{d_s}{100}\right]^{1.29}$ for various stack diameters versus stack velocity.

2. Rule 203.2. The H_2S ambient air level of 0.12 ppm for 30 minutes.

$$Q_a = 1.2 \times 10^{-4}\, V_s\, d_s^{\,2}\, \frac{1}{\left[\frac{d_s}{h_s}\right]^{1.29}} \qquad (2)$$

Symbols same as in equation (1) above.

B. For exit stack gas for temperatures greater than 125°F.

1. Rule 203.1. The H_2S ambient air level is 0.08 ppm for 30 minutes.

$$Q_a = 1.68 \times 10^{-3}\, V_s\, d_s \left[1.5 + 0.82\left(\frac{\Delta T}{T_s}\right) d_s\right] h_s \qquad (3)$$

Where:
Qa = emission rate, lbs/hr
V_s = stack exit velocity, ft/sec.
d_s = exit stack diameter, ft.
ΔT = temperature difference between stack gas and the outdoor atmosphere in °Rankine. An outdoor temperature of 90°F. (550°R) is assumed in preparing dispersion graphs.
T_s = stack exit temperature in °Rankine.

To plot Graph III assume a basic stack height of 100 ft. and an exit velocity of 20 ft/sec. Let stack gas temperature vary with stack diameter.

2. Rule 203.2. The H_2S ambient air level is 0.12 ppm for 30 minutes.

$$Q_a = 2.52 \times 10^{-3} \; V_s \; d_s \left[1.5 + 0.82 \left(\frac{\Delta T}{T_s} \right) d_s \right] h_s \qquad (4)$$

Symobls same as used in equation (3).

Example 1 (Temperature of stack gas less than 125°F.)

How many lbs/hr of H_2S can be discharged from a 200 ft. stack having a 4 ft exit diameter (ID) and a 30 ft/sec exit gas velocity? The stack gases temperature is 100°F and the distance to property line is 3000 ft. Emissions under Rule 203.1.

Solution

1. The ratio of stack diameter to 100 ft. is $\frac{4}{100}$ = 0.04
2. Enter ordinate of Graph II with 0.04; go horizontally to intersection of 30 ft/sec. velocity curve. At the intersection read on the abscissa 24 lbs/hr on (Rule 203.1) scale. This is the permitted value for a 100 ft. stack.
3. Correct emissions for a 200 ft. stack. Enter Graph I at 200 ft and obtain correction factor of 2.3. Thus the emissions become 24 x 2.3 = 55 lbs/hr.

Note: Less than 30 stack heights to property line - no credit.

Example 2 (Temperature of stack gas greater than 125°F.)

How many lbs/hr of H_2S can be discharged from a 200 ft. stack having a 4 ft exit diameter (ID) and a 30 ft/sec exit gas velocity? The temperature of the exit gases is 400°F. Emissions under Rule 203.1.

Solution

1. Enter ordinate of Graph III with 400; go horizontally to intersection of 4 ft. diameter, read on the abscissa on Rule 203.1 scale 36 lbs/hr emission. This is permitted value for 100 ft stack and exit velocity of 20 ft/sec.
2. Correct for stack height of 200 ft. This is direct ratio and becomes $\frac{200'}{100'}$ = 2. The emission now becomes 36 x 2 = 72 lbs/hr.

3. Correct for stack exit velocity of 30 ft/sec. This is a direct ratio and becomes $\frac{30}{20} = 1.5$. The allowed emission now becomes 72 x 1.5 = 108 lbs/hr.

Note: Less than 30 stack heights to property line - no credit.

APPENDIX I

NEW MEXICO

STREAM USE DESIGNATIONS AND STANDARDS

NOTE: These standards apply at all flows unless specified otherwise.

RIO GRANDE BASIN:

1. The main stem of the Rio Grande from the International Boundary and Water Commission sampling station above American Dam at El Paso upstream to one mile below Percha Dam.

   Designated Uses - Irrigation; limited warmwater fishery; livestock and wildlife watering; secondary contact recreation

   NOTE: Sustained flow in this stretch is dependent on release from Caballo Reservoir during the irrigation season; at other times of the year there is little or no flow; standards apply only at flows above 350 cfs.

   Standards:
   In any single sample:
   The dissolved oxygen shall be greater than 5.0 mg/l
   pH shall be within the range of 6.6 to 8.8
   Temperature shall not exceed 34°C (93.2°F)

   The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

   At mean monthly flows above 350 cfs, the monthly average concentration for:
   TDS shall be less than 2,000 mg/l
   Sulfate shall be less than 500 mg/l
   Chlorides shall be less than 400 mg/l

2. The main stem of the Rio Grande from one mile below Percha Dam upstream to the headwaters of Caballo Reservoir including Caballo Reservoir.

   Designated Uses - Irrigation; livestock and wildlife watering; primary contact recreation; warmwater fishery

   NOTE: Sustained flow in the stream reach below Caballo Reservoir is dependent on release from Caballo Reservoir during the irrigation season; at other times of the year, there is little or no flow; standards apply to the stream reach only at flows above 350 cfs. Also, these standards do not apply in Caballo Reservoir at pool sizes below 25,000 acre feet.

RIO GRANDE BASIN:

Standards:

In any single sample:

Dissolved oxygen shall be greater than 5.0 mg/l except for brief periods (6 hours or less) of not less than 4.0 mg/l
pH shall be within the range of 6.0 to 9.0
Temperature shall be less than 32.2°C (90°F)
Turbidity shall be less than 50 FTU

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml

The open water shall be free of algae in concentrations which cause nuisance conditions for gastrointestinal or skin disorders.

3. The main stem of the Rio Grande from the headwaters of Caballo Lake upstream to Elephant Butte Dam and perennial reaches of tributaries to the Rio Grande in Sierra County.

Designated Uses - Fish culture; irrigation; livestock and wildlife watering; marginal coldwater fishery; secondary contact recreation; warmwater fishery

NOTE: Flow in this stretch is dependent upon release from Elephant Butte Dam. Standards apply only during flows in excess of 100 cfs.

Standards:

In any single sample:

The dissolved oxygen shall be greater than 5.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 25°C (77°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

4. Elephant Butte Reservior

Designated Uses - Irrigation storage; livestock and wildlife watering; primary contact recreation; warmwater fishery

NOTE: These standards do not apply at pool sizes below 100,000 acre feet.

Standards:

In any single sample:

The dissolved oxygen shall be greater than 5.0 mg/l except for brief periods (6 hours or less) of not less than 4.0 mg/l
pH shall be within the range of 6.6 to 9.0
Temperature shall be less than 32.2°C (90°F)
Turbidity shall be less than 50 FTU

RIO GRANDE BASIN:

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

The open water shall be free of algae in concentrations which cause nuisance conditions and gastrointestinal or skin disorders.

5. The main stem of the Rio Grande from the headwaters of Elephant Butte upstream to the Angostura Division Works, including any flow below the perennial reaches of the Rio Puerco and Jemez River which enters the main stem of the Rio Grande.

Designated Uses - Irrigation; limited warmwater fishery; livestock and wildlife watering, secondary contact recreation

Standards:
In any single sample:
Dissolved oxygen shall be greater than 4.0 mg/l
pH shall be within the range of 6.0 to 9.0
Temperature shall be less than 32.2°C (90°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

At mean monthly flows above 100 cfs, the monthly average concentration for:
TDS shall be less than 1,500 mg/l
Sulfate shall be less than 500 mg/l
Chloride shall be less than 250 mg/l

6. The Jemez River and all its tributaries above the Town of Jemez Springs and the Guadalupe River and all its tributaries and all perennial reaches of tributaries to the Rio Puerco.

Designated Uses - Domestic water supply; fish culture; high quality coldwater fishery; irrigation; livestock and wildlife watering; secondary contact recreation

Standards:
In any single sample:
Ammonia nitrogen shall be less than 0.2 mg/l
Conductivity shall be less than 400 umhos (700 umhos for perennial reaches of Vallecito Creek)
Dissolved oxygen shall be greater than 6.0 mg/l or 85% or saturation, whichever is greater
Nitrate nitrogen shall be less than 0.8 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total chlorine residual shall be less than 0.002 mg/l
Total phosphorus shall be less than 0.1 mg/l
Total organic carbon shall be less than 7 mg/l
Turbidity shall be less than 25 FTU

RIO GRANDE BASIN:

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

7. The main stem of the Rio Grande from Angostura Diversion Works upstream to Cochiti Dam.

Designated Uses - Irrigation; livestock and wildlife watering; secondary contact recreation; warmwater fishery; coldwater fishery

Standards:
In any single sample:
Dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 9.0
Temperature shall be less than 25°C (77°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

8. Cochiti Reservoir.

Designated Uses - Livestock and wildlife watering; warmwater fishery; coldwater fishery; and primary contact recreation

Standards:
In any single sample:
The dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 9.0

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

The open water shall be free of algae in concentrations which cause nuisance conditons or gastrointestinal or skin disorders.

9. The main stem of the Rio Grande from the headwaters fo Cochiti Reservoir upstream to Taos Junction Bridge including the main stem of Embudo Creek from its confluence with the Rio Grande upstream to the junction of the Rio Puerco and the Rio Santa Barbara, and the Santa Fe River upstream to Siler Road.

Designated Uses - Irrigation; livestock and wildlife watering; marginal coldwater fishery; secondary contact recreation; warmwater fishery

Standards:

In any single sample:

The dissolved oxygen shall be greater than 6.0 mg/l (except Santa Fe River upstream to Siler Road where dissolved oxygen shall be greater than 4.0 mg/l)
pH shall be within the range of 6.6 to 8.6
Temperature shall be less than 22°C (71.6°C) [except Santa Fe River upstream to Siler Road where temperature shall be less than 30°C (86°F)]
Turbidity shall be less than 50 FTU

At mean monthly flows above 100 cfs, the monthly average concentration for:

TDS shall be less than 500 mg/l
Sulfate shall be less than 150 mg/l
Chloride shall be less than 25 mg/l

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

10. El Rito Creek above the Town of El Rito and Vallecitos Creek above Ojo Caliente Creek and all tributaries.

Designated Uses - Domestic water supply; irrigation; high quality coldwater fishery; livestock and wildlife watering; secondary contact recreation

Standards:

In any single sample:

Ammonia nitrogen shall be less than 0.2 mg/l
Conductivity will be less than 300 umhos
Dissolved oxygen shall be greater than 6.0 mg/l or 85% or saturation, whichever is greater
Nitrate nitrogen shall be less than 0.8 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total chlorine residual shall be less than 0.002 mg/l
Total phosphorus shall be less than 0.1 mg/l
Total organic carbon shall be less than 7 mg/l
Turbidity shall be less than 10 FTU

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

11. The Rio Chama from its confluence with the Rio Grande upstream to Abiquiu Reservoir, the Rio Tusos, and any flow below the perennial reaches of El Rito Creek and Rio Ojo Caliente which enters the main stem of the Rio Chama.

Designated Uses - Irrigation; livestock and wildlife watering; marginal coldwater fishery; secondary contact recreation

RIO GRANDE BASIN:

Standards:

In any single sample:

Dissolved oxygen shall be greater than 5.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 31°C (87.8°F) above Abiquiu Reservoir and less than 31°C (87.8°F) below Abiquiu Reservoir

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

12. Abiquiu Reservoir

Designated Uses - Irrigation storage, livestock and wildlife watering; primary contact recreation; coldwater fishery; warmwater fishery

Standards:

In any single sample:

Dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 25°C (77°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

The open water shall be free of algae in concentrations which cause nuisance conditions or gastrointestinal or skin disorders.

13. The Rio Chama from the headquarters of Abiquiu Reservoir upstream to El Vado Reservoir and the Rio Gallina and Rio Puerco de Chama north of Highway 96.

Designated Uses - Irrigation; livestock and wildlife watering; secondary contact recreation; coldwater fishery; warmwater fishing

Standards:

In any single sample:

Dissolved oxygen shall be greater than 5.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 26°C (78.8°F)

The monthly logarithmic mean of fecal coliform bacteria shall be less than 1,000/100 ml, and no more than 10% of the samples shall exceed 2,000/100 ml.

14. All perennial reaches of tributaries to the Rio Chama above Abiquiu Reservoir except the Rio Gallina and Rio Puerco de Chama north of New Mexico Highway 96 and the main stem of the Rio Chama from the headwaters of El Vado Reservoir, upstream to the New Mexico-Colorado line.

Designated Uses - Domestic water supply; fish culture; high quality coldwater fishery; irrigation; livestock and wildlife watering; secondary contact recreation

Standards:
In any single sample:
Ammonia nitrogen shall be less than 0.2 mg/l
Conductivity shall be less than 500 umhos (1,000 umhos for Coyote Creek)
Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater
Nitrate nitrogen shall be less than 0.8 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total chlorine residual shall be less than 0.002 mg/l
Total organic carbon shall be less than 7 mg/l
Total phosphorus shall be less than 0.1 mg/l
Turbidity shall be less than 25 FTU
The monthly lograithmic means of fecal coliform bacterial shall be less than 100/100 ml, and no more more than 10% of the samples shall exceed 200/100 ml.

15. El Vado and Heron Reservoirs

Designated Uses - Irrigation storage; wildlife and livestock watering; primary contact recreation; coldwater fishery

Standards:
In any single sample:
Dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Turbidity shall be less than 25 FTU
The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

The open water shall be free of algae in concentrations which cause a nuisance condition for gastrointestinal or skin disorders.

16. All perennial reaches of tributaries to the Rio Grande in Santa Fe County except the Santa Fe River below Siler Road.

Designated Uses - Domestic water supply; high quality coldwater fishery; irrigation; livestock and wildlife watering; municipal and industrial water supply; secondary contact recreation

Standards:

In any single sample:

Ammonia nitrogen shall be less than 0.2 mg/l
Conductivity will be less than 300 umbos
Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Total chlorine residual shall be less than 0.002 mg/l
Total phosphorus shall be less than 0.1 mg/l
Total organic carbon shall be less than 7 mg/l
Turbidity will be less than 10 FTU

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

17. The main stem of the Rio Grande from Taos Junction Bridge upstream to the Colorado-New Mexico line, the Red River from its confluence with the Rio Grande upstream to a point ½ mile above the Red River Fish Hatchery, and the Rio Puerco de Taos from its confluence with the Rio Grande upstream to Las Cordomas.

Designated Uses - Coldwater fishery; fish culture; livestock and wildlife watering; secondary contact recreation

Standards:

In any single sample:

Dissolved oxygen shall be greater than 6.0 mg/l
pH shall be within the range of 6.6 to 8.8
Temperature shall be less than 20°C (68°F)
Turbidity shall be less than 50 FTU

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

18. The Red River from a point 1½ mile above the bridge at the Red River Fish Hatchery upstream to its headwaters including all tributaries thereto and all other perennial reaches of tributaries to the Rio Grande in Taos and Rio Arriro counties.

Designated Uses - Domestic water supply; fish culture; high quality coldwater fishery; irrigation; livestock and wildlife watering; secondary contact recreation

Standards:

In any single sample:

- Ammonia nitrogen shall be less than 0.2 mg/l
- Conductivity shall be less than 400 umhos (500 umhos for the Rio Fernando de Taos)
- Dissolved oxygen shall be greater than 6.0 mg/l or 85% of saturation, whichever is greater
- Nitrate nitrogen shall be less than 0.8 mg/l
- pH shall be within the range of 6.6 to 8.8
- Temperature shall be less than 20°C (68°F)
- Total chlorine residual shall be less than 0.002 mg/l
- Total phosphorus shall be less than 0.1 mg/l
- Turbidity shall be less than 25 FTU
- Total organic carbon shall be less than 7 mg/l

The monthly logarithmic mean of fecal coliform bacteria shall be less than 100/100 ml, and no more than 10% of the samples shall exceed 200/100 ml.

APPENDIX J

Lake County Planning Commission
RESOLUTION 75-127

WHEREAS the Planning Commission of the County of Lake, State of California has considered the application for a Use Permit as applied for by Burmah Oil and Gas Company, 2828 Junipero Avenue, Long Beach, California for geothermal drilling, completion and placing on production of nine wells on a certain 60 acre leasehold (Dillingham and Vought) in the Anderson Springs vicinity, otherwise described as Assessor Parcel Numbers 13-06-65 and 13-06-66, being portions of Section 27 and 34, Township 11 North, Range 8 West, Mt. Diablo Base and Meridian in accordance with the Lake County Ordinance Code, and

WHEREAS said Planning Commission finds that the establishment, maintenance or operation of the use for which application is made will not under the circumstances of this particular case be detrimental to the health, safety peace, morals, comfort and general welfare of persons residing or working in the neighborhood of such use, or be detrimental to the property or improvements in the neighborhood, or be detrimental to the general welfare of the County and that the proposed use is in substantial conformity with the Lake County General Plan and that the proposed use is not a trivial action with no significant impact on the environment, and

WHEREAS said Planning Commission has caused to be prepared a Draft Environmental Impact Report and a Final Environmental Impact Report on the subject of this application and has held public hearings thereon and has carefully considered this matter pursuant to the California Environmental Quality Act and the Guidelines of the Resources Agency, State of California, pertaining thereto, and pursuant to the Environmental Protection Guidelines as referenced in the Ordinance Code, County of Lake, now therefore be it

RESOLVED that the Planning Commission of the County of Lake approves the Use Permit applied for, and be it

FURTHER RESOLVED THAT:

I. This Use Permit has been approved by the Planning Commission, subject to being issued after the expiration of the mandatory appeal period and after compliance with any conditions precedent. However, if the Use Permit is not issued before October 9, 1976, it will become null and void, and the use may not proceed without the application for and approval of a new Use Permit. The Planning Commission may in its discretion approve time extensions.

II. The Use Permit shall be subject to the following conditions:

A. Nine (9) production wells on five drill sites for a period of two (2) years commencing on the date of approval of the Use Permit and further subject to approval of site regarding location for three (3) wells by the Planning Commission prior to any drilling or site preparation, specifcially wells numbered 7, 8 and 9, which may require additional drill sites as may be determined.

B. TO PROTECT PLANT ASSOCIATIONS:

1. Top soil shall be stockpiled for later respreading over the disturbed area prior to re-seeding.
2. Specific pad/road sites shall be evaluated by a qualified horticulturist-landscape consultant to determine which native plants can be tolerantly sustained.
3. When construction/drilling has been completed, re-vegetation shall be programmed and shall commence in the fall of year following the construction or drilling.
4. The re-vegetation program shall be re-evaluated during the second Spring following initial planting and if deemed to be inadequately successfull additional re-vegetation will be required in the immediately succeeding fall season.

C. TO PROTECT WILDLIFE HABITAT:

Note: The E.I.R. on the basis of field reconnaisance, does not report the subject area as being likely habitat for rare and endangered species of animals. The report does not rule out the possibility but does not suggest any specific mitigating measures to protect them. Therefore, in order to minimize potentially adverse effects to the wildlife habitat generally, only one condition is recommended, although beneficent mitigations to wildlife are listed elsewhere.

1. Not more than twenty-five (25) surface acres of the sixty (60) acre leasehold shall be disturbed by the construction of drill pads, sumps and access roads without the specific authorization of the Planning Commission.

D. TO PROTECTION AGAINST EXCESSIVE SOIL EROSION, INDUCED LAND SLIPS AND SURFACE GEOLOGIC HAZARDS:

1. A Registered Civil Engineer and an Engineering Geologist shall certify all road excavation and site preparation plans.
2. A precise survey of the drill sites, the positioning of the equipment and a reserve pit area, the access roads including the extent of cuts and fills, the compaction methods and the storm drainage design plan and profiles shall be submitted to the Lake County Director of Public Works in advance of any excavation.
3. Filled slope banks shall not exceed 1 1/2:1. Edges of all fills shall be stabilized with rock and gravel or placed to reduce erosion potential to an absolute minimum on all fill slope banks. Revegetation of slopes shall be carried out as specified in Condition B.

4. A retaining levee of not less than eighteen inches (18") in height and three feet (3') in base thickness shall be placed on the perimeter of all fill areas to prevent storm runoff accumulation from random discharge.
5. A permanent silt trap of a design to impede the transport of silts from the area shall be installed and maintained on the upstream side of the Socrates Mine Road at its intersection with the principal watershed channel.
6. The drainage plan to be submitted will generally distribute storm water runoff over the downhill slope or collect runoff and channel it to existing natural waterways only to the extent that it will not increase water head to the point of unnatural channel abrasion. Energy dissipators and collection devices to reduce the erosive force of unnatural runoff may be required.
7. Drill pad locations shall be selected on areas of not more than an average of thirty percent (30%) natural slope without specific approval from the Planning Commission.
8. Steam well stimulation with the use of explosives shall not be permitted without specific approval from the Lake County Planning Commission.
9. All grading activity shall be completed and all drainage structures shall be in place and operational prior to October 10, of any year. Grading and excavation activity shall not be permitted during the consecutive period from October 10 to April 10 of any year. (It is understood that this is a general time frame. Extension beyond October 10 may be allowed by the Lake County Department of Public Works Director upon establishment of a soil moisture specification for any stated activity.

E. ENVIRONMENTAL AND SAFETY PROTECTIONS GENERALLY:

1. Engineered sumps shall be lined with impervious material to prevent any leaching of possible soil or water contaminants into local ecosystem.
2. Sump fluids (both mud and supernatant liquids) shall be monitored for type and quantity of biologically sensitive materials, especially toxic materials, heavy metals and radioactive materials. If said monitoring does not indicate quantities in excess of allowable limits for either human or other important biological elements, especially those of the aquatic ecosystem, then sump materials shall be solidified, dried, mixed with native soil and buried. If toxic or biologically sensitive materials are found, such materials shall be removed to a Class 2-1 disposal site as directed by the County or appropriate State agency. Sump pits shall be refilled to a self-stabilizing grade and be re-vegetated as required by Condition 3.
3. No drill site shall be located within five hundred feet (500') of any creek flowing ten (10) months or more during the year without specific approval from the Planning Commission.
4. No hydrocarbon based cleaning agent, no waste oils or greases, no liquid fuel shall be discharged directly onto the surface of a drill pad. All such liquids shall be contained and removed from the site.

5. All unattended drilling equipment, well heads, sumps, ponds, shall be protected from access by unauthorized persons.
6. The applicant shall comply with the requirements of fire prevention practices and measures as may be prescribed by the Chief, Middletown fire Protection District and/or the California Division of Forestry.
7. Sanitary and hand washing facilities shall be provided at the drill sites and maintenance yards as specified by the Lake County Health Department.
8. In the event of casing blow-out or other uncontrolled venting, applicant shall move immediately to control the vent. No more than five (5) days shall elapse from the date of the uncontrolled vent to the date of equipment relocation to secure it.
9. Alternate sites for water source shall be approved by the Planning Commission.
10. Water trucks shall operate only during daylight hours.

F. TO PROTECT AIR QUAILTY:

1. The applicant shall meet the Ambient Air Quality Standards established by the Lake County Air Pollution Control District Regulations.
2. It is stipulated that the said District will be spot monitoring climatic conditions, quantities of non-condensible gasses in the vicinity of the proposed use and that the findings resulting from said monitoring may require the applicant, his contractors or agents to provide continuous air quality monitoring and sample readings as may be directed by the Lake County Air Quality Pollution Control District.
3. Applicant shall secure a Permit to Operate from the Lake County Air Pollution Control District prior to commencement of drilling activity.
4. Applicant shall provide dust control measures on all vehicular access routes as may be required by direction from the Lake County Air Pollution Control District.
5. Applicant shall provide, upon request from the Lake County Planning Commission, element-component readings from a steam analysis.

G. TO PROTECT AGAINST EXCESSIVE NOISE EXPOSURE:

1. The maximum permitted sound level during any phase of the operation shall not exceed 65 db (A) at a distance of one-half (1/2) mile from the drill site.
2. It is stipulated that the Lake County Air Pollution Control District will be spot monitoring noise levels in the vicinity of the proposed use and that findings resulting from said monitoring may require the applicant, his contractors, or agents, to provide continuous noise level monitorings and readings as may be directed by the Lake County Air Pollution Control District.
3. Applicant shall install a separator-muffler device to contain all discharges during the drilling and testing phase.

H. TO PROTECT VIEWS AND SCENIC VISTAS:

1. Drill sites 7, 8 and 9 shall be relocated as recommended on Figure 6, page 16 of the referenced E.I.R. to avoid adverse

geologic soils and view impact.

I. IN GRANTING THIS USE PERMIT THE LAKE COUNTY PLANNING COMMISSION MAKES THE FOLLOWING FINDINGS:

1. That this Use Permit does not abridge or supersede the regulatory powers or permit requirements of any State or Federal Agency or any Special District or other Lake County Department or Division which may retain an advisory or regulatory function as specified by statute or ordinance, nor does this Use Permit grant any title or other real property right solely to this applicant or his assigns.
2. That the granting of this Use Permit is in the general public interest and that environmental and performance parameters conditioning the proposed activity as specified in this Use Permit and as contained in that document entitled, "Conditions, Procedures and Performance Standards for Geothermal Regulations, County of Lake", now referenced and made a part hereof, will allow the proposed activity with adequate safeguards to the welfare of the people of Lake County at large and to the people residing in the vicinity of said activity.
3. That this Use Permit shall be subject to revocation or modification by the Board of Supervisors of Lake County if:
   a. The Board finds that there has been non-compliance with any of the foregoing conditions, or
   b. The Board finds that the use for which this permit is granted is so exercised as to be substantially detrimental to the general public or to property in the vicinity of the use.

   Any such revocation shall be taken pursuant to Section 21-84 of the Ordinance Code of the County of Lake.
4. That this Use Permit is issued for a period of two (2) years and shall expire on October 9, 1977.

The foregoing resolution was introduced by Commissioner Dennis Bailey who moved its adoption, seconded by Commissioner Richard Broten on this 9th day of October, 1975, and carried by the following roll call vote:

AYES: Commissioners Dennis Bailey, Richard Broten, Al Moorhead, Harvey Sampson, and Chairman Nancy Stolesen

NOES: None

ABSENT: None

WHEREUPON the Chairman declared the above and foregoing resolution duly adopted.

SO ORDERED!

Lake County Planning Commission
Nancy Stolesen, Chairman
Doris W. Wilcox, Secretary

AFFIRMATION: I have read the above conditions and will comply.

Signature of Applicant